MODERN PLASTICS

DECEMBER 1952

Are you UP on today's developments in new "working" plastics?

GLASS-FIBRE-FILLED PHENOLIC

RUBBER-FILLED PHENOLIC

PLATABLE PHENOLIC

CORROSION-PREVENTIVE PHENOLIC

● Extraordinary new developments are expanding the industrial importance of phenolic plastics these days. Materials possessed of "working" properties in combinations unheard of 5 years ago ...even a few months ago... are furnishing new answers in product improvement and development programs.

Suppose you are looking for impact strength up to 20 ft. lbs. per inch (Izod), yet readily moldable into finished shapes with high surface luster? We've developed this at Durez by using glass fibre as a filler. How about an opposite class of material...a flexible type, rubber-filled, for service where shock is severe? Or one that eliminates corrosion of silver contacts in electrical devices? Or a conductive material you can mold, then *plate* with copper, nickel, or other metals?

Inherent in such Durez developments as these are potential savings in production time and cost worthy of investigation now. New utility for your product, new beauty and sales appeal too may well come out of a conference with your custom molder of Durez phenolics. Our field technicians are always at your service.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

Our monthly "Durez Plastics News" will keep you informed on industry's uses of Durez. Write, on office letterhead.

DUREZ PLASTICS & CHEMICALS, INC.
1212 Walck Road, North Tonawanda, N. Y.

PHENOLIC PLASTICS THAT FIT THE JOB

"—from the ground up"

These flower pots molded of colorful **Catalin Styrene** *do more than hold the good earth*

. . . they encourage plant growth!

The bases of these interestingly varied Planters* have a secret to share with you. Each is a sub-irrigating receptacle, holds a week's supply of water, and some feed nourishment up thru to the plant chamber by way of a provided wick which can be quickly threaded into place. Should we say this innovation gives bloom "a new *leash* on life"?

Certainly, it is to be admitted CATALIN STYRENE makes for a more abundant, cheerful home life. Today, thru bright colors, low cost, good design and modern plastics processing, products molded of CATALIN STYRENE promote kitchen efficiency, bring new conveniences to the bath and powder room, enhance the dinette, decorate the living room . . . and *keep good house* in every room of man's castle!

**Products of Quality Molding Company, Chicago 39, Ill.*

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CATALIN

In addition to Styrene Molding Compounds, Catalin chemical products include a wide range of Urea, Phenolic, Cresylic, Resorcinol, Melamine and Styrene Resin formulations.

MODERN PLASTICS*

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*Reg. U.S. Pat. Office

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not make this plastic clay. We supply the Geon paste resin only.

CHRISTMAS GIFT *that gives you something!*

PLASTIC modeling kits like this one are big sellers in toy departments and novelty stores—a profit-maker for the manufacturer who thought up the idea.

The plastic clay, based on Geon paste resin, is modeled by hand, then baked a few minutes in the kitchen oven to make it tough yet flexible. More than a toy, it's an application of a new idea in plastics! For this same process can be used in pattern work, jigs, tools, dies, negative and positive molds.

The versatility of Geon has a way of doing that—stimulating saleable ideas. Just think of the range of articles made from Geon—shower curtains and flooring, belts, dolls, electrical insulation—there seems to be no end to Geon's possibilities!

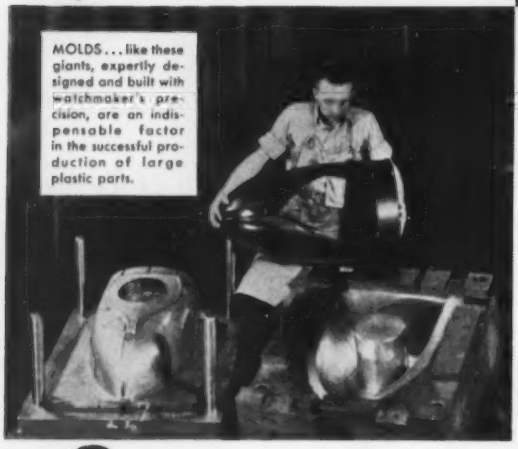
Supplied as resins, latices or compounded plastics, Geon materials make products resistant to heat and cold . . . water . . . weather . . . abrasion and most chemicals. They can be used for coating, casting, molding or dipping. Brilliant or delicate colors are possible. Start with those advantages, and you have a head start on developing or improving a product to bring in more sales. For technical advice, write Dept. GA-12, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

GEON RESINS • GOOD-RITE PLASTICIZERS . . . the ideal team to make products easier, better and more saleable

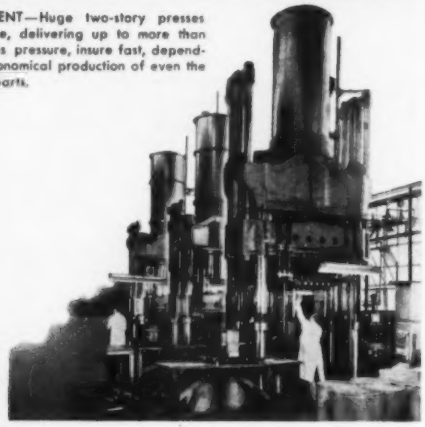
GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

IT TAKES ALL THIS TO MOLD BIG PLASTIC PARTS RIGHT

ENGINEERING—There is no substitute for the skill and know-how of these Chicago Molded engineers with 15, 20, 25 and 30 years experience under the same management.



MOLDS... like these giants, expertly designed and built with watchmaker's precision, are an indispensable factor in the successful production of large plastic parts.



EQUIPMENT—Huge two-story presses like these, delivering up to more than 1500 tons pressure, insure fast, dependable, economical production of even the largest parts.

EXPERIENCE — Since the 1920's, Chicago Molded has pioneered the molding of large units. These are typical of parts produced for some of the biggest names in industry.

PLUS . . . the ability to analyze and understand your needs and interpret them correctly . . . the seasoned judgment to avoid misapplications . . . the faculty for getting into production without undue delay and to plan each operation so as to achieve maximum efficiency and economy . . . the knowledge of materials and techniques that comes only with years of solving just about every conceivable plastics application.

These plus factors are all important. They represent values and economies that are reflected in the final cost to you . . . and in the complete customer satisfaction which is a part of every Chicago Molded job.

Ready to talk about your plans? Call in a Chicago Molded engineer. There's no obligation. Just write, wire or phone.

CHICAGO MOLDED PRODUCTS CORPORATION

CUSTOM MOLDERS OF ALL *Plastics*

1046 NORTH KOLMAR AVENUE CHICAGO 51, ILLINOIS

EDITORIAL

Every Knock is a Boost!

That there is truth in trite titles is evidenced by the above example. Plastics materials, products, and product components are getting some queer publicity today through both snide and blatant attacks on plastics by those whose interests are vested in materials which are being superseded by plastics.

The leather interests, the wood-working interests, the ceramic interests, the metal interests, and others are registering pain because of the rapid and steady invasion of their traditional fields by plastics.

The latest bigoted and blatant attack on plastics concerns their use in molded television cabinets. Certain television manufacturers have been persuaded that it is to their advantage to advertise their cabinets as "genuine wood, not plastics." The indoctrination has, in some instances, been carried right down to the retail salesman who is taught to harp on the implication that the plastic cabinet is (a) not tonally correct, (b) not of home furnishing quality and appearance, and (c) not what would be merited by the customer's investment involved in such a major purchase.

This is the old political technique of the "big lie." The principle is to tell such a whopper so loudly and so often that people may come to believe it. It is the technique of desperate men, but it gets publicity.

Of course it is a lie. In the first place, every wooden television cabinet is bonded with plastics and finished with plastics. And without five or more different plastics in its innards, there would be no such thing as a television receiver. In the second place, a whale of a lot of television cabinets are made of metal finished to look like wood—and the finish is plastic. In the third place, a television cabinet is a functional piece of furniture which should be designed to fit into modern living, which means that it should be resistant to abrasion and wear, proof against swelling by humidity and shrinking in a dry atmosphere, resistant to liquids and cigarette burns, sufficiently light in weight for portability, and of a shape and color that will harmonize with other home furnishings. In the fourth place, a television receiver is subject to engineering obsolescence and must be designed with a view to trade-in economics.

Plastics television cabinets, particularly for table models, fill all these functional requirements and still meet the economic needs of manufacturers and consumers.

It stands to reason that the more money a television manufacturer has to put in cabinets the less he can put into tubes and electronic components for a given price. As far back as January 1950, MODERN PLASTICS reported that a large television company, with its own timberstands, its own sawmills, and its own wood cabinet factories, can buy plastics cabinets from custom molders for about 15% less than the cost of wooden cabinets, and can therefore give more functional television value for the same money in a plastic cabinet.

We believe it to be the duty and opportunity of everyone in every section of the plastics industry to combat big lies with every facility at his command. Involved are future big markets for plastics, particularly for large unit molding in the furniture field, the business machine field, the appliance field, the store equipment field, and elsewhere.

Every Knock is a Boost—but only if the big lie of the knocker is exposed quickly and vigorously.

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MIDGET GRANULATOR CUTTER

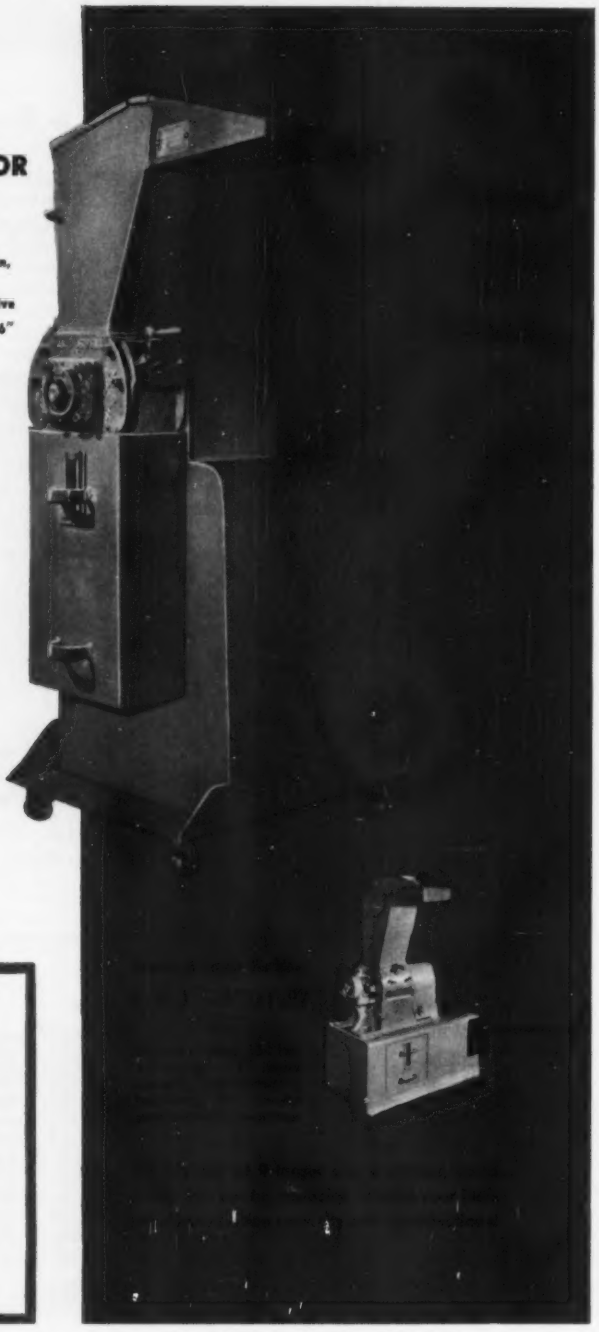
CAPACITY: 50-75 lbs. per hr., based on 5/16" screen, polystyrene scrap.

HORSEPOWER: 1—V-belt drive

THROAT OPENING: 5½" x 6"

FLOOR SPACE: 19" deep, 21" wide, 50" high

WEIGHT: 430 lbs.



SPECIAL DESIGN ADVANTAGES

- Newly designed hopper and table for more efficient feeding.
- Specially designed for operation alongside molding machines for immediate regrinding of scrap materials.
- Handles gates, sprues, etc., from ¼" to ½" sectional thickness, dependent on type material.

Your grinder source for every individual plastic material cutting requirement and capacity (50 to 3,000 lbs. per hr.)—Ball & Jewell, machine tool builders since 1865, have always paced the plastics industry. Send us your requirement specifications.

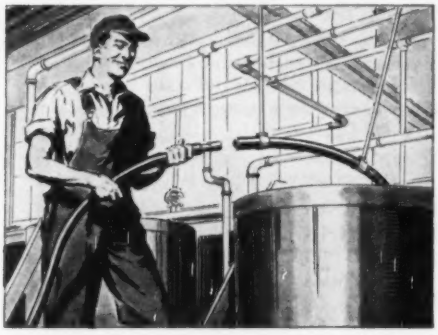
BALL & JEWELL, INC. *Leadership Through Continuous Engineering Improvements*

22 FRANKLIN STREET, BROOKLYN 22, NEW YORK

Pipe of Du Pont "ALATHON" is non-corrosive, flexible, light

CORROSIVE MINE WASTES that attack ordinary pipe have no effect on pipe made of "Alathon." Its flexibility, light weight, and availability in long lengths permit easy, economical installations. "Alathon" is unbreakable . . . long service life reduces costs.

JET WELLS, irrigation and watering systems using this pipe are economically and easily installed. Its smooth surface does not accumulate scale . . . gives increased flow. And it is unaffected by freezing of internal fluids.



INDUSTRIAL APPLICATIONS include transmission lines for chemicals, low-pressure gases, sewage and food-processing solutions. "Alathon" resists most chemicals and mold and bacteria growth . . . is non-contaminating.

Cuts installation and maintenance costs . . . outlasts ordinary pipe

Pipe made of Du Pont "Alathon"* polythene resin offers these advantages:

1. **Resistance to corrosive materials.** At ordinary temperatures, "Alathon" has outstanding resistance to most chemicals and solvents in common use.
2. **Rapid, economical installation.** Pipe of "Alathon" is light, flexible. Long lengths easily follow contours . . . require few fittings.
3. **Freedom from taste, odor, toxicity.** "Alathon" contains no plasticizer. Pipe is particularly suitable where purity control is important.
4. **Durability.** Pipe of "Alathon" needs no protective coating. It is unaffected by rust, rot, electrolytic corrosion . . . and freezing of internal fluids . . . gives long service life over a wide range of temperatures.

Pipe of Du Pont "Alathon" is made by several manufacturers. A few uses are illustrated.

But pipe is only one example of the product improvement possible with "Alathon." Flexible housewares, toys and bottles, and insulation for wire and cable are other important uses. Perhaps it can help you improve or develop a product. For further information, write:

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department; District Offices:
350 Fifth Avenue, New York 1, New York
7 S. Dearborn St., Chicago 3, Illinois
845 E. 60th Street, Los Angeles 1, California

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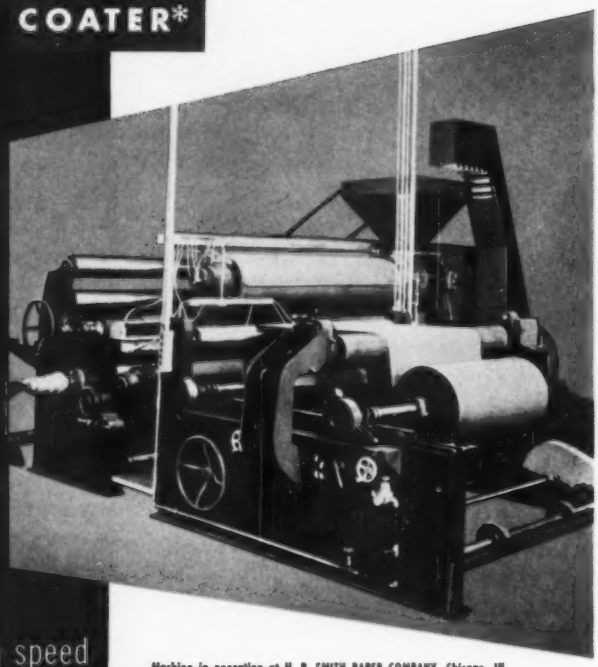
Egan

POLYETHYLENE COATER*

CONTROL PANEL

All controls are mounted in a special operator's control stand with the top panel inclined for ease of viewing and handling. Completely enclosed.



Machine in operation at H. P. SMITH PAPER COMPANY, Chicago, Ill.

high speed continuous operation

Another in the series of Frank W. Egan & Company developments and installations, this is the latest Extrusion-type coater for applying polyethylene at speeds up to 1000 FEET PER MINUTE.

The polyethylene is extruded from a die and the extruded film is laminated to the paper between the nip of two rolls.

This coater incorporates automatic splicing unroll and reroll equipment for high speed operation.

*With Patented Features

Send for pamphlets on coating, treating and laminating

FRANK W. EGAN & COMPANY
Bound Brook, New Jersey
Designers and Builders of Machinery
for the Paper Converting and Plastics Industries
Cable Address: "EGANCO"—Boundbrook, N. J.

What's Behind All the Excitement?

Betsy McCall©, inspired by the copyrighted feature in McCall's Magazine. Manufactured by Ideal Toy Corporation, N.Y.

Mary Hartline, lifelike reproduction of famous TV Star of Super Circus, Sunday afternoon, ABC. Mfd. by Ideal Toy Corp., N.Y.

Every new "Ideal" doll is the signal for excitement among toy retailers. Betsy McCall and Mary Hartline are no exceptions. But, long before the debuts of these famous dolls, there were many hours of careful planning by Ideal's designers and production men. The result: two dolls that rate high in quality as well as child appeal!

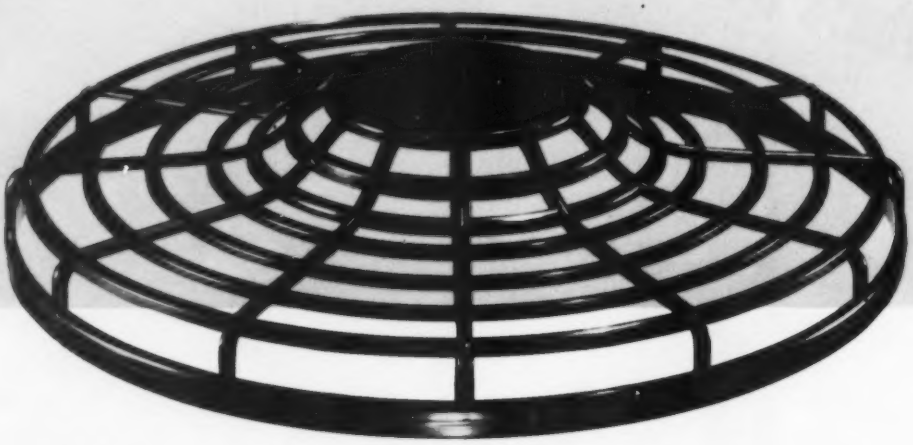
In recreating McCall's Magazine famous Betsy McCall and TV's own Mary Hartline, Ideal has used tougher, durable Celanese* *acetate*. This fast-molding plastic, long noted for its perfection of molding detail, surface beauty and permanence, is just about the best assurance of long play-life and extra play-safety that a toy can have.

That's why Celanese *acetate* Plastic is the choice of leading manufacturers of quality toys. With *acetate*, they know that the hazards of breakage-in-shipment, counter-damage, rejects and returns are cut to the minimum, and customer-satisfaction is assured. Celanese Corporation of America, Plastics Division, Dept. 101-L 180 Madison Avenue, New York 16. In Canada, Canadian Chemical & Cellulose Company, Ltd., Montreal and Toronto.

Celanese* Acetate PLASTICS

*Reg. U. S. Pat. Off.

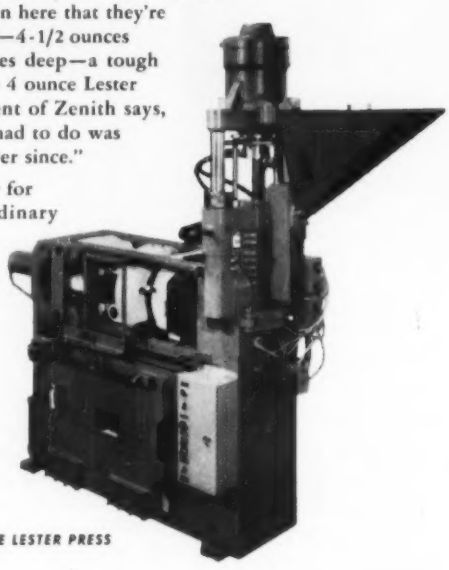
4½ ounces from a 4 oz. LESTER



At ZENITH PLASTICS in Cleveland, they like the L-1/2-4 ounce Lester. It's small wonder when you examine the part shown here that they're running on the 4. It's a vacuum cleaner motor guard—4-1/2 ounces of acetate, 10-1/8 inches in diameter, about 2 inches deep—a tough job to fill without showing weld marks. But on the 4 ounce Lester they do it easily. As Paul Zurlinden, Vice-President of Zenith says, "We're delighted with the 4 ounce Lester. All we had to do was install it and it started running—and it has been ever since."

Here is the Lester machine that is offered especially for *fully automatic molding* of small shots at extraordinary production rates, or its full rated capacity at competitive cycles. The Zenith part clearly shows the extra capacity built into all the new Lester equipment. Besides, the cut-off attachment for molding nylon is standard on this machine.

Yes, day-in, day-out, trouble-free performance in one plant after another is the experience of satisfied Lester users. If you want to check complete specifications, write to Lester-Phoenix or the representative in your area listed below.



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How Kralastic® made *a tough case for a tiny instrument*

The Sonotone Corporation, a leader in the science of hearing correction, had a problem. Until they talked to Naugatuck!

For the frame of their Model 940 hearing aid, they needed a plastic that was both **hard** and **tough**—to take years and years of everyday use. It had to have **unusual dimensional stability**—to preserve extremely close tolerances. And it had to have great **strength,** even in paper-thin sections—to eliminate unwanted weight and bulk.

Naugatuck's Kralastic styrene copolymer met these rigid requirements perfectly! What's more, it gave plus values—like the heat resistance that greatly reduced assembly rejects caused by soldering heat.

Just look how different the completed instrument is from the "loud speaker" grandpa lugged around. So light, it weighs no more than a pocket flashlight! So compact, it can be worn in a vest pocket—**or even in a lady's hat!**

If you have a material problem... if you need high impact strength, combined with hardness and excellent dimensional stability, it will pay you to investigate Kralastic resins. Why not send us the coupon below, today!

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Naugatuck Chemical Plastics Division, 212 Elm Street
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COMPANY _____

ADDRESS _____

CITY _____

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How many custom molders' reputations lie buried here?

FIT THE RIGHT TYPE FASTENER TO THE JOB, *NOT* THE JOB TO THE FASTENER

TYPE Z

HEX HEAD Z

TYPE F

TYPE F-Z

TYPE U

When excessive breakage occurs in assembling plastic parts, who gets the blame? It's the custom molder, in too many cases, while the real culprit is the *wrong type* fastener.

If molding is your business, you can protect your reputation by consulting Parker-Kalon about fasteners before your customers' assembly lines get into motion.

If you are a manufacturer, get fastening recommendations from P-K before parts spoilage sends your planned profit to the scrap can.

The P-K ASSEMBLY ENGINEER is a fastening expert who is ready to help you plan how to save operations, simplify assemblies, add product strength. And, he'll show you how to make those planned savings *pay off* on the assembly lines. He'll call at your request, or, send specifications of your product for recommendations. Parker-Kalon Corporation, 200 Varick St., New York 14.

DELIVERIES ARE BETTER . . . SPECIFY P-K

Since P-K, the originator of the Self-tapping Screw, makes a complete line, recommendations are unbiased. Find out why so many fastener-wise manufacturers say, "If it's P-K, it's O.K."

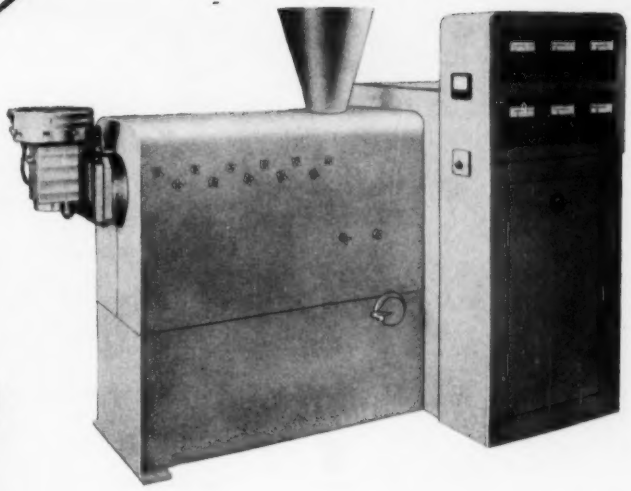
P-K TRADE MARK REG. U.S. PAT. OFF.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

FOR EVERY METAL AND PLASTIC ASSEMBLY

The extruder that gives standout performance



3½" MPM extruder, in operation all over the world.

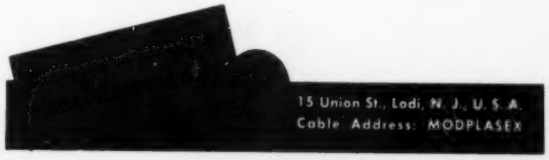
Every week of every month sees the development of new thermoplastic materials. Particularly in the field of extrusion, where temperatures, speeds and flow characteristics are so critical, these new materials often outstep the ability of existing extrusion machinery to process them.

But not necessarily . . . if the extruder is an MPM! These advance-design extruders have continuously proven their ability to master the difficulties connected with extruding unfamiliar thermoplastics. The combination of ample vari-speed drives, screw speed indicators, cored screws, automatic temperature regulators and as many as fifteen radially jacketed cylinder cooling zones gives each MPM extruder unsurpassed flexibility of operation.

It is for these very features that MPM extruders are the outstanding choice for experimental extrusion development work in the laboratories of eighteen leading materials suppliers. Chances are the new plastics you will be using in the near future are being put through their paces right now . . . on MPM extruders.

The long service of MPM extruders is guaranteed by solid corrosion resistant construction for all parts which contact the plastic resin. To this add simplified installation and completeness even to dies and auxiliary equipment, if required, and you will certainly want to give some thought to MPM when buying an extruder.

(West Coast Representative)
4113 W. Jefferson St.,
Los Angeles 16, Calif.



KLEESTRON

the *VERSATILE* plastic

No need to state the virtues of polystyrene.
It is accepted all over the world for its versatility . . .
its adaptability. At long last the designer has been given
a moulding powder reasonably free from limitations.
No need either to state the virtues of Kleestron.
Enough to say it is made by Kleemann's
in their new factory at Welwyn Garden City
and is being sold . . . and moulded . . .
and praised all over the world.

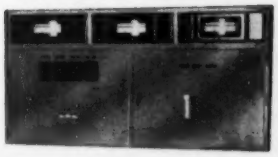
Address all enquiries to the sole manufacturers:—

O. & M. KLEEMANN LTD.

WEST HALKIN HOUSE · WEST HALKIN STREET · LONDON · S.W.1 · ENGLAND

Cables — KLEEMABRO · LONDON

Three-zone temperature control



the SURE KEY to higher plastics production

the W-S 16 OUNCE HORIZONTAL MOLDING MACHINE

Experience has shown that the day-to-day shirt-sleeve jobs are done most economically on the intermediate size machines—notably the famous W-S 16 ounce Injection Molder.

There's more than size, however, behind the outstanding preference for this model. Consider, for example, a single machine in which *all* these features are offered:

- Extra long heating cylinder for increased plasticizing efficiency . . . COMPARE!
- Three-zone temperature control . . . COMPARE!
- Replaceable bronze bushings in cylinder and moving platens...COMPARE!
- Faster cycles with dual pressure controls . . . COMPARE!
- Hydraulic and electric safety controls . . . COMPARE!
- Special pumping unit . . . COMPARE!
- Remote control panel . . . COMPARE!

If *your* profits are coming in something less than the full measure, it will pay you handsomely to investigate this profit-booster NOW. Detailed literature and/or personal analysis without obligation.

W-S HYDRAULIC

THE WATSON-STILLMAN CO., DIV. OF H. K. PORTER COMPANY, INC.

150 Aldene Road Roselle, New Jersey

Foreign Sales Representatives: OMNI PRODUCTS CORP., 460 Fourth Ave., New York 16, N. Y.

Correspondents Throughout the World

"We just untangled that production snarl, Boss!..

We've discovered CLOPAY'S Coated Products are custom-made to fit the job.

Clopay specializes in the application of thermosetting and thermoplastic coatings to any paper or fabric. Up-to-the-minute facilities and production know-how assure compliance with the most rigid specifications. And, Clopay compounding techniques provide the most versatile range of properties . . . ideal for any protective or decorative use.

CHECK CLOPAY FOR:

CAST VINYL FILM . . . A product of high stability formulated to combine physical and chemical properties tailored to meet the most exacting requirements. Ideal for electrical insulations, non-toxic applications, pressure-sensitive tapes, moisture and water barriers and other special uses embracing rigid specifications.

COATED PRODUCTS . . . Thermosetting and Thermoplastic coatings applied to any paper or fabric. For all protective and decorative uses.

CLOPANE . . . Extruded, clear, protective packaging film is competitive in price with standard packaging materials but with all the superior advantages of Vinyl.

NON-CORROSIVE PIPE . . . Extruded pipe including rigid unplasticized Polyvinyl Chloride resists alkalis and most acids. A valuable contribution to the petroleum, mining and chemical industries. Available in U.S. Standard Pipe sizes and special sizes to order.

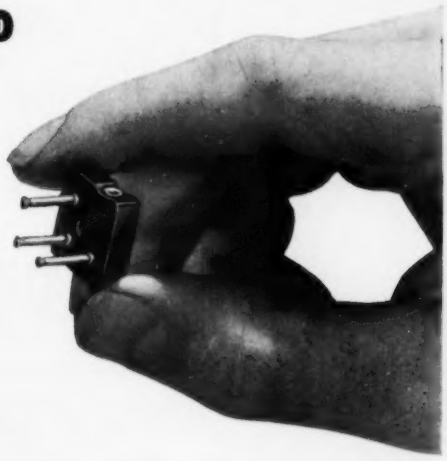
INDUSTRIAL PRODUCTS DIVISION

CLOPAY corporation

NEW YORK: 386 Fourth Ave., Room 608
Phone: Murray Hill 3-8066

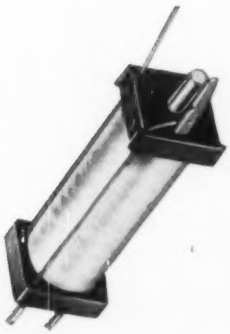
CLOPAY SQUARE, CINCINNATI 14, OHIO • *Phone: DUnbar 4800*

ASK FEDERAL TELEPHONE AND RADIO ABOUT KURZ-KASCH MOULDED PLASTICS!



ASK ABOUT THE PROBLEM! This moulded plastic spool assembly consists of two parts—both intricate and delicate challenges to the moulder. The front part is moulded with a threaded brass insert, an iron core, an extended contact point plus four moulded .093" dia. bosses. Rear assembly has as integral parts a threaded brass insert, three minute pin type terminals, plus four .046" dia. through cored holes and one cored hole for mounting. They're shown here actual size.

ASK ABOUT K-K MOULD-MAKING SERVICE! These parts were needed fast. The numerous inserts moulded in at all angles necessitated complete cavities disassembled on the bench for ejection. Yet our first 4-cavity transfer mould with 2 sets of impressions was ready for production *ahead* of a very tight schedule.



ASK ABOUT K-K MOULDING PRODUCTION! Shipments are required in quantity—and on specified schedules, of course. And that's just the type of service that we specialize in delivering!

THEN ASK YOURSELF . . . *"If Kurz-Kasch can keep on satisfying leading manufacturers like Federal Telephone and Radio Corporation—and as long as it has had a record like that for over 36 years—why don't we try Kurz-Kasch ourselves?"* WHY NOT? We solicit your inquiry.

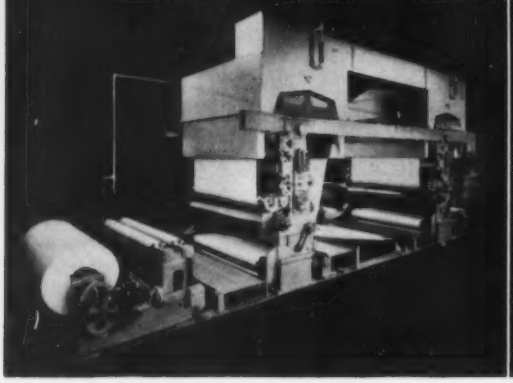
Kurz-Kasch, Inc. • 1415 S. Broadway • Dayton 1, Ohio

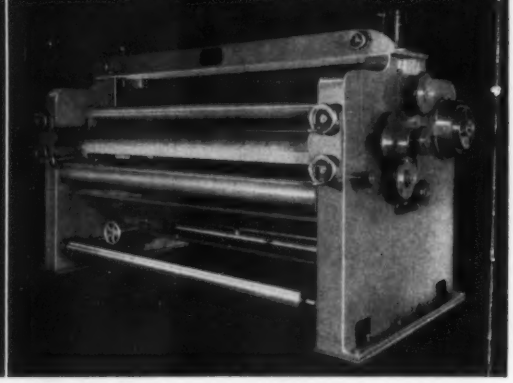
BRANCH SALES OFFICES: New York, *Lexington 2-6677* • Rochester, *Hillside 4352* • Chicago, *Merrimac 7-1830* • Detroit, *Trinity 3-7050* • Philadelphia, *Hilltop 6-6472* • Dallas, *Logan 1970* • Los Angeles, *Richmond 7-5384* • St. Louis, *Delmar 9577* • Toronto, *Riverdale 3511*
EXPORT OFFICE: 89 Broad Street, New York City, *Bowling Green 9-7751.*

Kurz-Kasch
FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS

Paper *plus* + ...by SORG

...GRAVURE PRINTING...ANILINE PRINTING...COATING and TREATING





For the past 100 years SORG has been a top name in the making of special papers. Now, to that ability to create specially-formulated base papers designed to meet your individual requirements, SORG has added these "PLUS mill services" — gravure printing, aniline printing, surface coating and saturating.

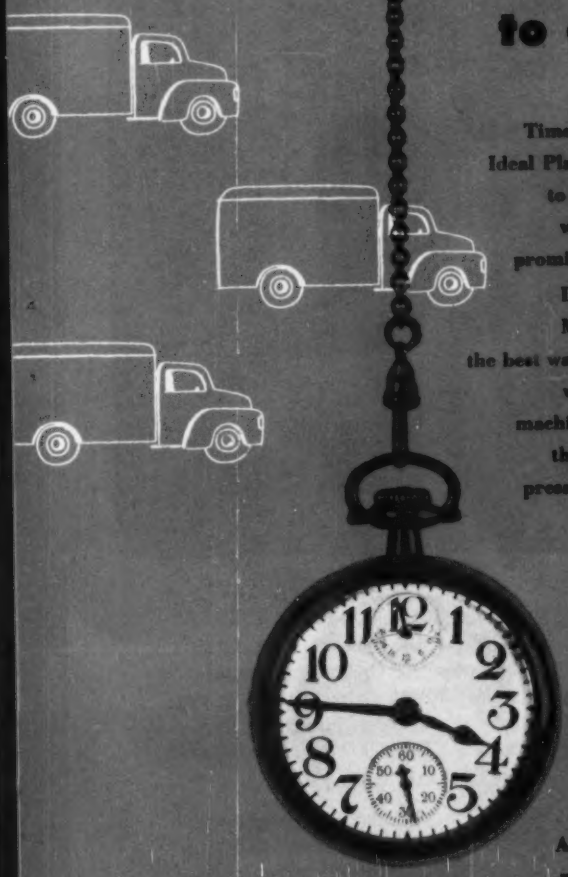
The PLUS of Gravure offers high speed, web-fed 2-color gravure printing on a wide range of base papers from strong industrial kraft to fine book paper. The PLUS of Coating offers precision application of synthetic resins, organosols, plastisols, and elastomers on a range of specially-formulated base papers with unusual accuracy of treatments.

When planning your product and packaging consider the advantages and economy of "Paper Plus ... by Sorg." Call in your nearest Sorg Representative for a consultation on your problems—or write Product Development, Dept. PX, of the Sorg Paper Company.

SORG PAPERS — SINCE 1852 TESTED BY TIME

1852-1952—100 Years of Service To The Users of Printing and Converting Papers

When delivery time is short



ask Ideal Plastics to custom mold for you

Time means money . . . haste often means profits. And Ideal Plastics is one custom injection molder you can count on to make your products in double-quick time, if that's the way you need them. Ideal operates on the theory that a promise of delivery constitutes an obligation that must be met.

Ideal is in a particularly good position to give fast service. Many years in the plastics business have taught us that the best way to have a thing done on time is to do it ourself; that's why so many of the molds we use are made by our own machinists in our own multi-million dollar toolrooms. With the flexibility given us by our immense range of injection presses, it's rare for an order to be held up because the right size and type molding machine isn't readily available. Also, we have finishing facilities which are probably the finest and most complete in the country.

Ideal's service consists of much more than fast delivery of precision-made moldings. You can count on the easy-on-the-budget pricing Ideal is so widely known for, and on helpful suggestions on product design and merchandising.

Regardless of your need for extra-fast service, contact Ideal Plastics about your next molding assignment. Acquaint yourself with this cooperative custom injection molding organization—the largest one there is. Write to A. C. Manovill, Vice President in Charge of Sales, Ideal Plastics Corporation, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000. Mid-West Representative: Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136

Better Molded Plastics **Ideal** for Industry & Home

HESS, GOLDSMITH introduces

FORM-FAB

the all glass fabric
that
S-T-R-E-T-C-H-E-S

Another Hess, Goldsmith first — FORM-FAB a "deep draw" glass fabric fully attenuated for maximum strength — ingeniously constructed so that the fabric actually stretches while the yarns remain stable — allowing for the even distribution of the fibers — and enabling the fabric to fit perfectly over semi-spherical objects.

FORM-FAB stretches with equal strength in all directions. And while it can be adapted to many different shapes, it lends itself particularly to semi-spherical types.

You are cordially welcome to come in—or write our technical experts—regarding FORM-FAB and all other Hess, Goldsmith glass fiber fabrics.

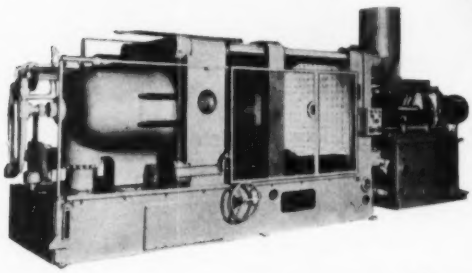
HESS, GOLDSMITH & CO., INC.—Industrial Products Division,
1400 Broadway, New York 18, N. Y. WI. 7-8900

Largest and Oldest Weavers of Glass Fabrics in the United States
Mills: Wilkes-Barre, Pa. · Philadelphia, Pa. · Plymouth, Pa. · Pleasantville, N. J.

75th year

Serving Industry With All-Hydraulic Machines For Every Pressure Processing Need!

HPM



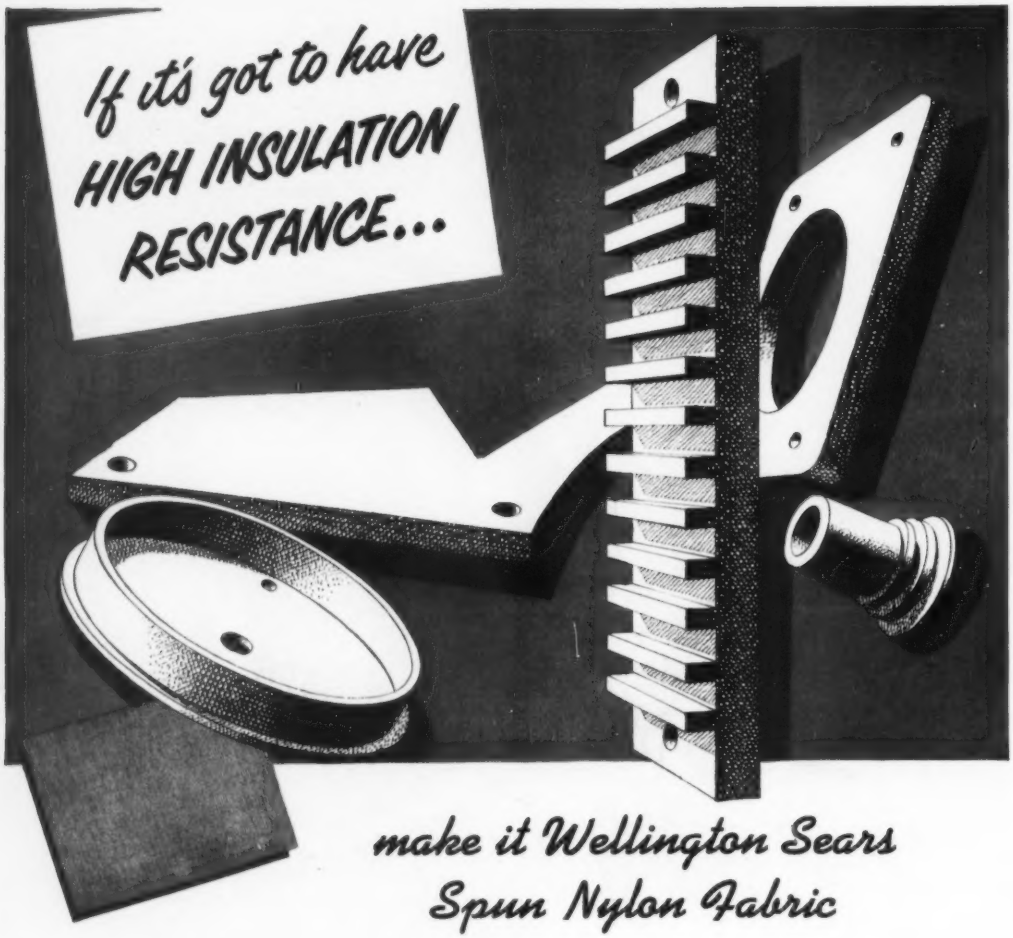
thank you . . .

PLASTICS INDUSTRY . . . . . your continued confidence in H-P-M and the all-hydraulic presses and power equipment we build has made this our 75th anniversary possible.

Through advanced research and proper application of the knowledge we have gained through 75 years of specialized experience in our chosen field, hydraulics, we shall continue to design and build the all-hydraulic pressure processing equipment best suited to your requirements.

THE HYDRAULIC PRESS MFG. COMPANY

1010 MARION ROAD — MOUNT GILEAD, OHIO, U. S. A.



make it Wellington Sears Spun Nylon Fabric

superior reinforcement for electrical laminates

Wellington Sears Spun Nylon fabric has found wide use in end product applications for the electronic and high frequency fields. The nylon staple fibers in the fabric contribute high bonding strength and provide laminates with superior insulation resistance under high humidity conditions.

These staple fiber nylon fabrics are made 28 to 72 inches wide in weights of about 5 ounces per square yard and higher. In addition, fabrics of continuous filament nylon, Orlon* and other synthetic fibers, as well as special constructions for unusual applications, are available to laminators from Wellington Sears.

While a partial list of fabrics for both laminating and coating is at the right, you will find further information and the complete answer to your fabric problem at your nearest Wellington Sears office. Make it your "headquarters for industrial fabrics."

An illustrated 24-page booklet filled with valuable facts on fabric development and applications of interest to present and potential users of industrial fabrics is yours for the asking. Write for a free copy of "Modern Textiles for Industry" to Wellington Sears Co., Dept. J-4, 65 Worth Street, New York 13, N. Y.

*DuPont's trade mark for its acrylic fiber.

Superior Fabrics for Coating and Laminating

Single filling ducks
Army ducks
Single and plied-yarn chafers
Special ducks
Sateens
Twills
Broken twills
Drills
Sheetings
Nylon, rayon and other synthetics
Lantuck non-woven fabrics

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A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST In Fabrics For Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

OFFICES IN: ATLANTA · BOSTON · CHICAGO · DETROIT · LOS ANGELES · NEW ORLEANS · PHILADELPHIA · SAN FRANCISCO · ST. LOUIS

Our wide range of quality controlled phenolics embraces a combination of properties suitable to almost any application. To solve production problems... improve product performance... or add sales appeal...look to Plenco for the *right* plastic!

Phenolic thermosetting molding compounds are produced in general purpose grades and materials with special impact strength, heat resistance, or properties for deep drawing of large castings. Special purpose molding compounds in blacks, browns, mottles and other colors for particular molding requirements.

we supply the right combination

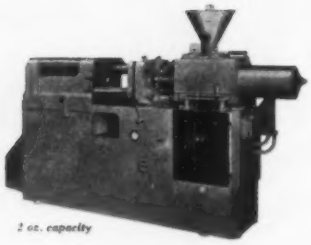
Phenolic synthetic resins are manufactured in dry, lump and finely ground particle sizes, or in solution adaptable to the application. Plenco engineers are available to help insure the success of a product through the stages from research to application.

PLENCO PHENOLICS

FOR BETTER PLASTIC PRODUCTS

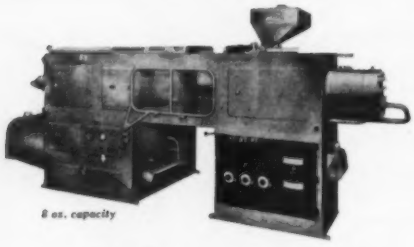
For additional information on the forms, properties, and advantages of Plenco Phenolics, write to:

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin



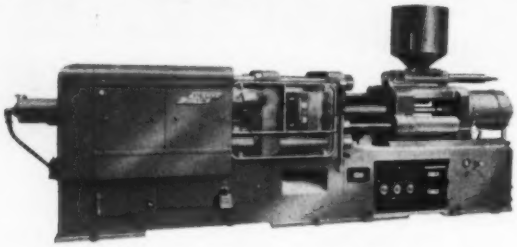
2 oz. capacity

There's one name outstanding



8 oz. capacity

for Injection Moulding Machines-



16 oz. capacity

The PROJECTILE & ENGINEERING
COMPANY LIMITED

PECO Injection Molding Machines are supplied in 2, 4, 8 and 16 oz. capacities. They are self-contained with automatic cycle and are hydraulically operated, and have a high plasticising capacity and rate of injection. Mold-locking pressure and platen area enable them to operate at a high rate production. Full particulars of the PECO range of Injection Molding Machines and Molds will be sent on request.

MOLDS. Expert designers and mold makers are employed and molds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for molds and medallions—the plant includes 3,000 ton hobbing plant. Master hobs to customers' samples made as required.

ACRE STREET, BATTERSEA, LONDON, S.W.8. ENGLAND

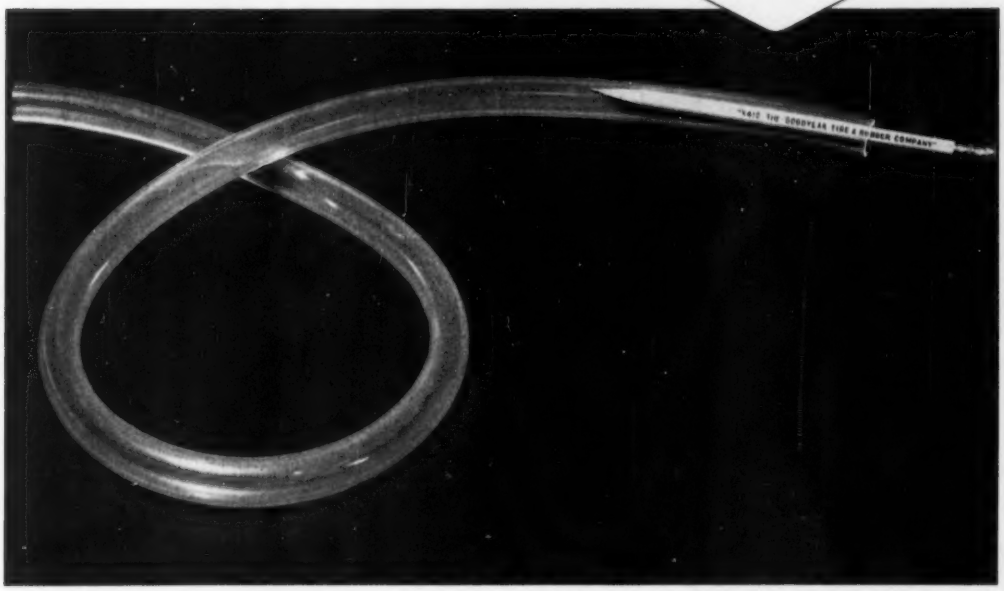
Telegrams: "Profectus, Claproad, London."

BRITISH-MADE PECO PRODUCTS

Cables: Profectus, London.

CLEAR PROOF

—YOU'LL DO BETTER WITH PLIOVIC



Outstanding clarity and flexibility mark this extruded vinyl hose made with PLIOVIC—*Goodyear's use-proved vinyl resin.*

EVEN in extruded hose or tubing, you can get clarity without loss of strength, flexibility or gloss when you use one of the new PLIOVIC resins. And you can extrude directly from the pre-mix with this use-proved Goodyear vinyl resin—eliminating time-wasting mill mixing. Whatever your manufacturing method may be, you can use PLIOVIC—and process more easily at lower temperatures.

Rigid or pliable, clear or opaque, PLIOVIC products have outstanding chemical resistance, heat and light stability and excellent physical properties. So look to PLIOVIC for new applications using vinyl resins and latices.

For details and samples, see a Goodyear Chemical Division Representative, or write:

Goodyear, Chemical Division, Akron 16, Ohio

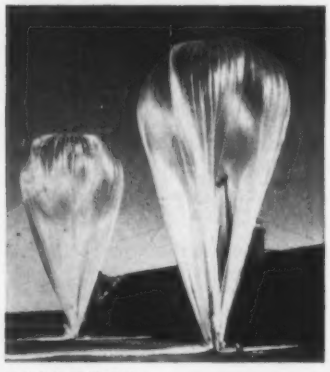
CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Pliolite, Pliovic—T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

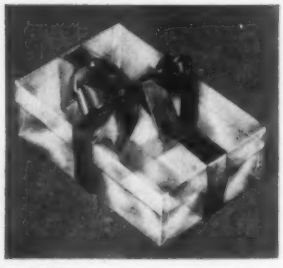
Use Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

You can use PLASTICS more effectively by coming to PLAX

BOTTLES New 6½ and 13-gallon Plax carboy bottles solve problem of handling and shipping industrial chemicals with complete safety — a Plax origination.



BALLOONS High flying weather balloons use specially made Plaxpak polyethylene film—another Plax research triumph to meet exceptional product requirements.



BOXES These can be formed of Polyflex sheet without adhesives or heat sealing. This oriented polystyrene sheet is brilliantly clear, low in cost. It's another unique Plax product.

If it's a packaging problem, the unbreakable Plaxpak® polyethylene bottle may have the answer. Or it might be Polyflex, our crystal clear polystyrene sheet that's being used for everything from greeting cards to battery strips.

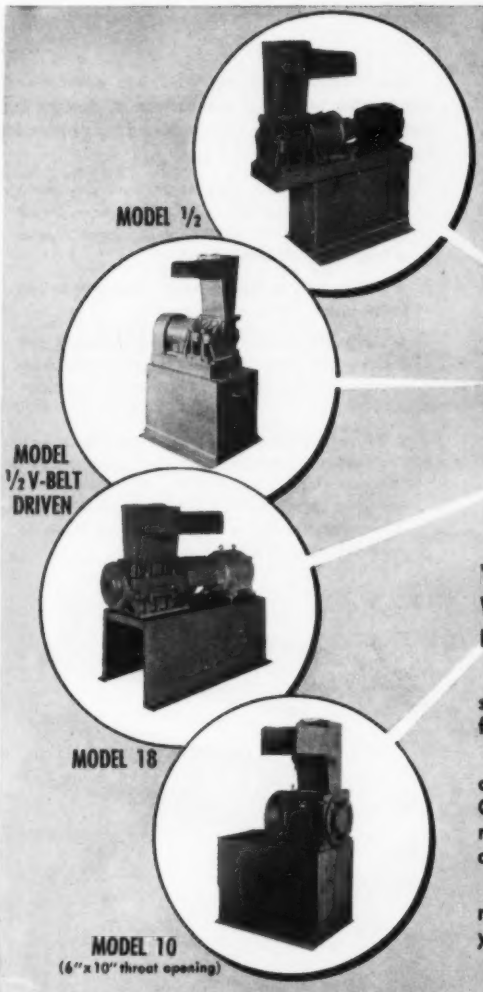
If it's functional or decorative, our thermoplastics sheets, rods, film or tubing may hold the key. We can help you select the right material and the best form for most economical production.

If it's a special problem, we offer you the assistance of our research and development facilities — and a background of broad experience in handling government and private industrial contracts.

PLEASE WRITE FOR CATALOG, DESCRIBING OUR PRODUCTS AND SERVICES

PLAX CORPORATION Subsidiary of Emhart Mfg. Co., HARTFORD 1, CONN.
In Canada, Plax Canada, Ltd., Toronto—District Sales Offices: New York, Chicago and other principal cities.
Plax® blow-molded products made under U.S. Pats. 2129239, 2175053, 2175054, 2230188, 2230190, 2260750, 2283751, 2349176, 2349177, 2349178

PLAX FOR PLASTICS NOT SUBSTITUTES IMPROVEMENTS



There's a **CUMBERLAND GRANULATOR** that's *RIGHT FOR YOU!*

YOU'LL GRANULATE MORE ECONOMICALLY WITH A CUMBERLAND MACHINE THAT'S BUILT-FOR-THE-JOB.

Each granulating job in your plant has its own specific problems. Only a granulator that's built-for-the-job can do the job most efficiently.

Whether you granulate combs or television cabinets, brittle or elastomeric materials, there's a Cumberland granulator designed to meet your needs. Each machine is easy to operate, easy to clean, and extremely rugged.

We'll be glad to help you analyze your needs and recommend the granulator that's exactly right for you!

For more information, write for Bulletin 251.

OTHER CUMBERLAND MACHINES

NEW PREBREAKER

Cuts up radio, television cabinets and other large parts. Two machines available: Model 32 (20" x 32" throat opening); Model 24 (10" x 24" throat opening). Write for details.

ROTARY CHOPPING MACHINE

Heavy duty, rugged machine. Used for cutting thick vinylite slabs from two roll mills. Also used as large capacity pelletizer. Other applications are described in Bulletin 400.

PELLETIZING MACHINE

Smaller, companion model to Rotary Chopper. Designed specifically for use with continuous extruders. Gives efficient, trouble-free performance. Write for complete details.

CUMBERLAND Engineering Corporation

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. I - BOX 218 - PROVIDENCE - RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
2325 Jesse Street, Los Angeles 23, Cal.

WIRE INSULATING EXTRUDERS

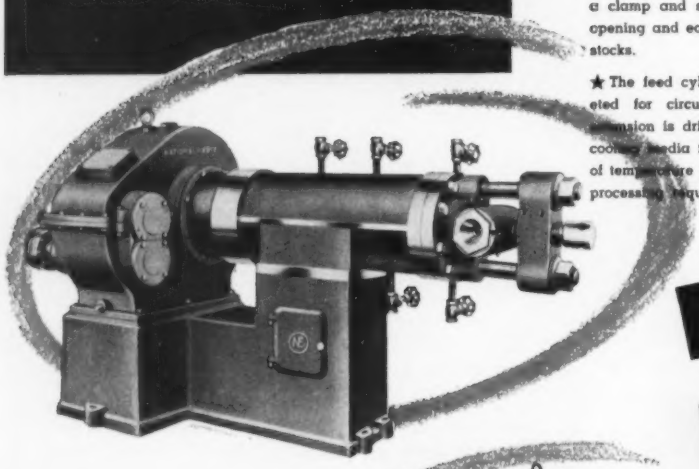
The National Erie extruder has been developed, after years of experience in design and use, into a machine with outstanding production features:

★ Drive gearing with precision cut gears and heavy duty thrust bearings of ample capacity have proved the superiority of National Erie design through years of trouble-free operation.

★ Anti-corrosive abrasion resistant cylinder liners and Stellite tipped screws insure long life.

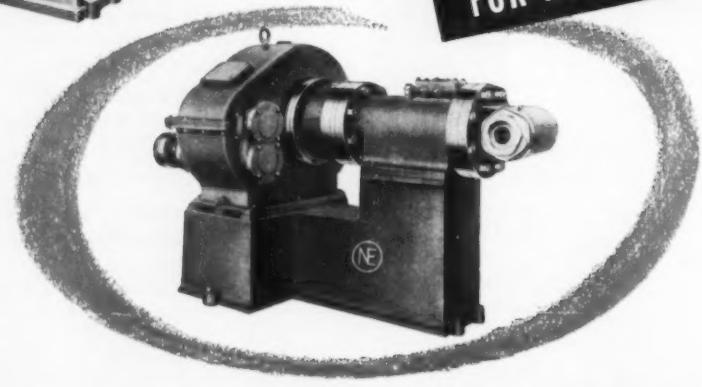
★ The plastics insulating extruder is equipped with a clamp and swing type head which permits quick opening and easy access for cleaning when changing stocks.

★ The feed cylinder on the plastics machine is jacketed for circulation of water and each cylinder section is drilled for circulation of the heating and cooling media for zone temperature control. A choice of temperature control systems is available to suit the processing requirements of any material.



FOR PLASTICS

FOR RUBBER



A typical 4½" plastics insulating machine is illustrated above. A typical 3½" rubber insulating machine is illustrated at the right. Both of these machines are available in sizes 1½", 2½", 3½", 4½" and 6". Other sizes available as special designs.

NATIONAL ERIE STAFF JOINS HALE AND KULLGREN, INC.

The engineering organization of National Erie, including personnel, drawings and records, have transferred to the offices of Hale and Kullgren, Inc., at 613 East Tallmadge Avenue, Akron, Ohio, and are available to you for prompt service on your processing problems. Complete service on parts and information for all existing National Erie equipment is available.

Complete service on National Erie equipment

SALES · ENGINEERING · MANUFACTURING

HALE AND KULLGREN INCORPORATED

Aetna-Standard

THE AETNA-STANDARD ENGINEERING CO.
PITTSBURGH, PA.

Plants in Warren, Ohio
Ellwood City, Penna.

Monsanto PLASTICIZERS for MODERN heat-sensitive adhesives

The glue pot is becoming as obsolete as the surrey with the fringe on top. High-speed machinery for fabricating, packaging, and labeling needs *modern*, heat-sensitive adhesives that keep pace with today's way of doing things.

Monsanto Plasticizers can help you formulate adhesives that high-speed production demands. With these plasticizers, you can make superior adhesives based on polyvinyl acetate, zein, casein, polyvinyl butyral, styrene, ethyl cellulose and vinylidene chloride.

Meet *your* customers' needs for modern adhesives for labeling, sealing or fabricating . . . or adhesives for special applications . . . with bonding agents made with Monsanto Plasticizers. For information on the use of Monsanto Plasticizers in adhesives . . . or for technical service . . . contact the nearest Monsanto Sales Office, or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 S. Second Street, St. Louis 4, Missouri.

MONSANTO PLASTICIZERS for heat-sensitive adhesives

Diphenyl Phthalate

Physical Constants

Molecular weight	318.3
Refractive index at 74° C.	1.572
Specific gravity at 20° C.	1.28
Flash point	435° F. (224° C.)
Boiling point (760 mm.)	405° C.
Physical form	White powder
Melting point	Approx. 69° C.

Specifications

Appearance	Coarse white powder or fused solid having a slight yellowish cast
Acidity (as phthalic)	0.20% max.
Free phenol	0.20% max.
Ash	0.05% max.
Moisture	0.50% max.

Santicizer 1-H

Physical Constants

Molecular weight	253
Density (solids)	1.125
Crystallizing point	86°-87° C.
Physical form	White crystals
Boiling point	350° C. (approx.)

Specifications

Appearance	Fine, white crystals
Melting point	86° C. min.

Santicizer 3

Physical Constants

Molecular weight	199.3
Density (solids)	1.253 gm./ml.
Flash point	371° F. (188° C.)
Melting point	59.0° C.
Physical form	Practically white solid
Boiling point (760 mm.)	340° C. (approx.)

Specifications

Appearance	Practically white solid
Maximum color	APHA 60 (molten)
Melting point	58.0° C. min.
Acidity (as acetic)	0.10% max.
Refractive index at 65° C.	1.512-1.532
Specific gravity at 65/65° C.	1.166-1.176

Santicizer 9

Physical Constants

Molecular weight	171.2
Density (solids)	1.353 gm./ml.
Flash point	420° F. (206° C.)
Melting point	105° C.
Maximum color (molten)	Barrett 3.5
Physical form	Fine granular particles
Boiling point (760 mm.)	360° C. (approx.)

Specifications

Appearance	Fine white to light cream granular particles
Melting point	105° C. min.
Melt	Liquid, clear and light yellow
Maximum acidity	pH 4.6, minimum in dilute acetone (2-gram sample in 15 cc. A.R. acetone and 35 cc. of CO_2 free distilled water)

PLASTICIZERS

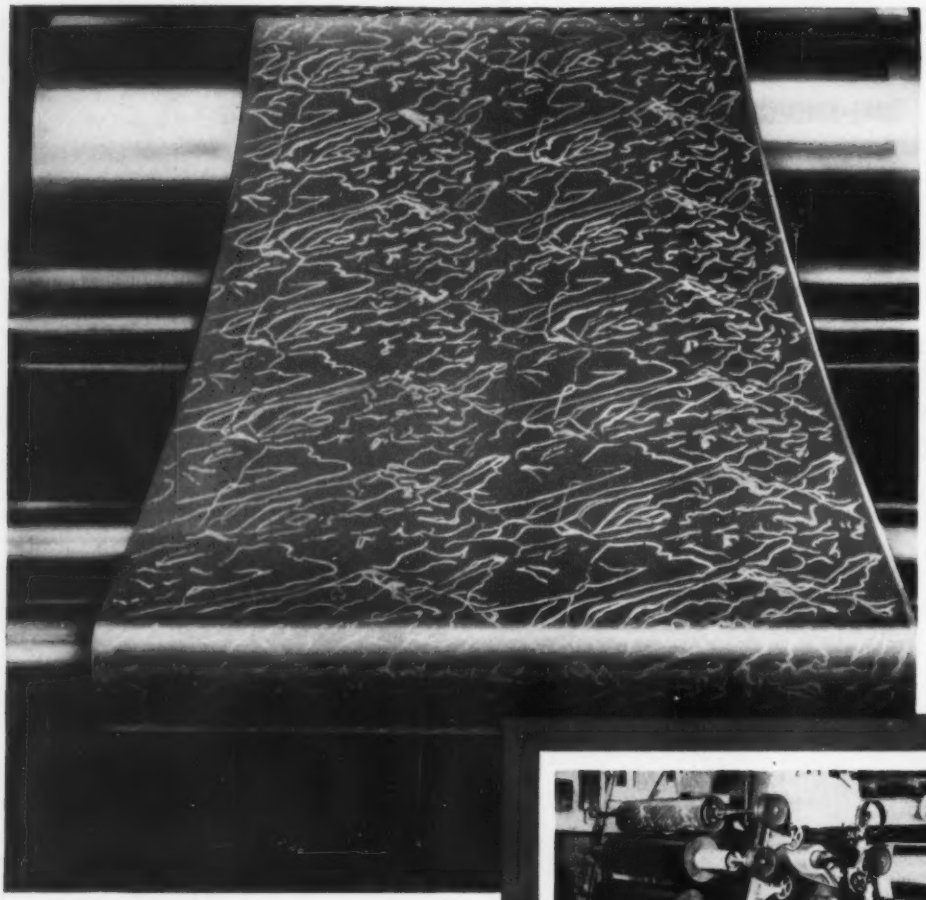
DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Oregon, San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

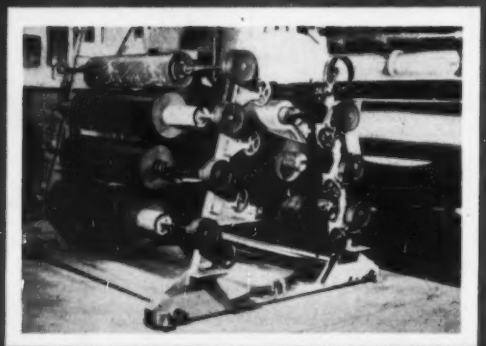
Santicizer: Reg. U. S. Pat. Off.

MONSANTO CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

NOW! CONTINUOUS





BWH ROTOCURE producing Vinyl Counter Topping

Finished laminated counter top issues from the Rotocure in a long continuous strip. Material, of course, can be slit into any width rolls on the Rotocure if desired.

To produce the counter top, above, several individual calendered plies are fed into Rotocure for continuous lamination (as shown at right). This six-ply set up consists of a clear film for the wearing surface, a printed vinyl surface, and four backing plies of a highly filled vinyl.

LAMINATED PLASTICS

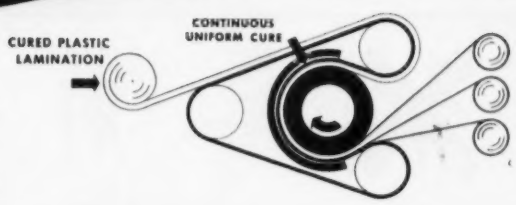
Any Length... Yes Any Length!

UP TO 1" thick 72" wide

Here's a New Way to Cut Your Costs . . . BY USING THE BWH ROTOCURE PROCESS

BWH was the first to do it with rubber. Now BWH is the first to do it with plastics . . . laminated plastics in any lengths you want . . . uniformly cured and rolled in one long piece by the famous BWH Rotocure Process.

Look into the possibilities of continuous laminated plastics. They could be the answer to many of your problems. They could be the means of cutting both your raw material and fabricating costs.



HOW THE ROTOCURE OPERATES

This schematic layout illustrates the principle of the Rotocure's operation. A line contact pressure of 100,000 pounds is exerted at the point where the pressure roll meets the curing roll, and pressure is maintained during the entire travel of the material on the curing roll by an endless steel belt. Heat is applied by the curing roll, as well as from the shoes riding on the metal belt which is in tension against it.

With its famous Rotocure Process, long used by BWH in making laminated rubber, BWH is now producing laminated plastics in continuous, *more economical runs*. It's a process that involves no costly lost time . . . opening, reloading, unloading and closing . . . as in the case with flat press lamination. It's a process that eliminates all limitations as to length of any sheet. And the stock peels off an endless polished belt with a high surface finish.

Highly flexible in operation, the Rotocure Process permits BWH to weld a number of plies up to 1" thick and 72" wide . . . with or without embossing . . . at any required speed and with temperatures as high as 340°F and pressures up to 60 p. s. i.

Leading companies are already switching to continuous laminated plastics because of the savings in cost they offer. Full particulars on the possibility of BWH producing your stock by continuous lamination will be supplied at your request. Write today.

Partial list of materials laminated on BWH ROTOCURES

Flexible vinyls — Polyesters
Rigid vinyls — Copolymers

The above vinyls can also be laminated with the following materials

Natural and synthetic fibre cloths — Aluminum foil
Woven glass cloth — Plain and printed papers

Typical products that can be produced more economically with continuous laminated plastics

Desk and counter top material · Synthetic leather
Shoe soling · Record preforms · Flooring
Luggage materials · Upholstery material · Stair treads

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

CAMBRIDGE, MASS. · P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

BWH

NEW odorless PLASTICIZERS

CHEMICALLY PURE — 99.7% ESTER CONTENT

BEFORE Hatco DCP and DIOP		AFTER Hatco DCP and DIOP
	Your Plant Workers	
	Your Neighbors	
	Public Health Officials	
	Consumers	

HATCO (Dicapryl Phthalate)

HATCO (Di-iso-octyl Phthalate)

Tested and Proved Under Actual Plant Conditions

After three years of intensive research and development, **Hatco** has produced the first completely odorless plasticizers. With **Hatco** DCP and DIOP (and the other **Hatco** odorless plasticizers), you are assured a uniform product at all times; 99.7% *minimum* ester content eliminates variation, giving you more pounds of pure plasticizer per dollar.

In addition, these two new odorless plasticizers enable you to produce a much more acceptable finished product.

Fewer rejections due to high water extraction. Tablecloths and shower curtains, for instance, retain their suppleness under repeated washings.

Write for free sample(s) and data sheets.....

HATCO CHEMICAL COMPANY M.P. 1
P.O. Box 72, Harrison, N. J.
Send free sample of HATCO DCP ☐ HATCO DIOP ☐ and data sheets.
Name & Title .....
Firm Name .....
Street & No. .....
City ..... Zone ..... State .....

HATCO CHEMICAL COMPANY
P.O. Box 72 Harrison, N. J.

Distributors for Rubber and Plastics Industry – Harwick Standard Chemical Co.

S-C-O-O-P!

This large plastic scoop was originally developed for handling ice cubes from automatic ice machines. Since then it has proved superior for bulk items such as chemicals, salt, sugar, feed, flour, grain, seed, etc.

Features

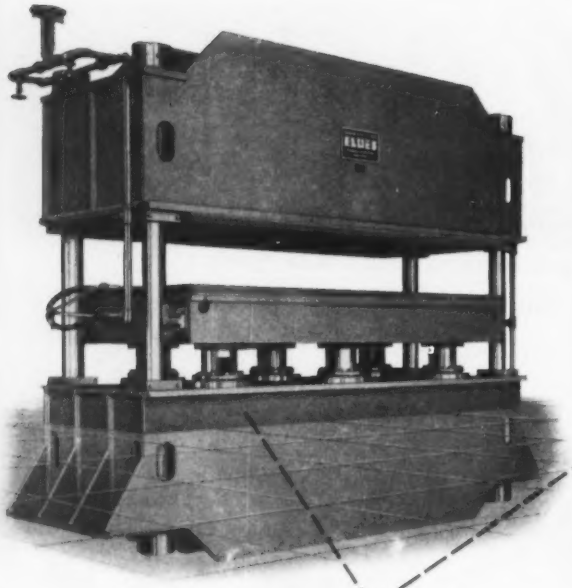
- ★ DURABLE
- ★ NON-CORROSIVE
- ★ SANITARY
- ★ LIGHTWEIGHT
- ★ SMOOTH LUSTROUS SURFACE
- ★ CAPACITY: APPROX. 2 QTS.

Mincor

MINNESOTA PLASTICS CORPORATION

INJECTION MOLDERS OF THERMOPLASTICS

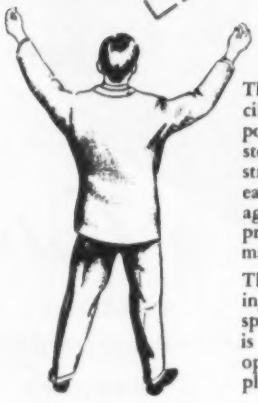
GARFIELD 5368 • 366 WACOUTA ST., ST. PAUL 1, MINNESOTA • NESTOR 3144



PUT YOUR "Pressing Problems" UP TO ELMES

Elmes 450-Ton Hot Plate Press

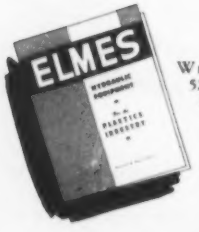
Hot Plate Dimensions: 106" L-R x 55" F-B
Stroke and Opening: 14"



Custom-built ELMES Hot Plate Press molds low-pressure polyester resins

This Elmes 450-Ton Hot Plate Press has been designed specifically to customer requirements for molding of low-pressure polyester resins. Construction is almost entirely of welded steel. Crown, bed, platen are heavy, one-piece weldments, fully stress relieved. Six single acting cylinders, of 75-tons capacity each, are set into the press bed, unrestrained. Rams bear against finished pads beneath the moving platen, and the press system is arranged so that only the two center cylinders may be actuated if desired.

The hydraulic system is self-contained. A dual-pressure pumping unit provides a high closing speed and moderate pressing speed. Gravity returns the platen downward. Press operation is completely pushbutton controlled. During semi-automatic operation an adjustable timer effects press opening upon completion of the work cycle.



Write for Bulletin 5200-A "Elmes Hydraulic Equipment for the Plastics Industry."

WHAT ARE YOUR REQUIREMENTS IN PLASTICS MOLDING PRESSES?

Elmes designs and builds a *complete line* of presses for the plastics molding industry. Whatever your requirements—compression or transfer molding presses, small production or laboratory presses, in standard designs or custom-built to specifications—it will pay you in profits to *"put your pressing problems up to Elmes."* Why not discuss your needs with our engineering staff? There is no obligation whatsoever.

American Steel Foundries

ELMES ENGINEERING DIVISION

METAL WORKING PRESSES • PLASTIC MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

New chemical blowing agent expands resins at low cost...

This close-up of an expanded resin shows the uniform cell structure produced with "Unicel" ND. (Magnification — 15x)

DU PONT "UNICEL" ND

FAST, SURE RESIN EXPANSION at surprisingly low cost is assured with "Unicel" ND. This highly efficient blowing agent produces fine, uniform cells in various types of resins . . . permits close control of resin density. To plastics manufacturers, this means a broad new field of application where insulating value and buoyancy are important.

SPECIFICATIONS FOR "UNICEL" ND

Composition . . . 40% Di-N-nitrosopentamethylenetetramine, 60% inert filler

Appearance . . . Cream-colored powder

Screen Size . . . At least 99.5% passes a No. 100 screen. (Size of opening 0.149 mm.)

Rigid to soft flexible cellular material may be easily obtained by varying the amount of plasticizer mixed with "Unicel" ND. Volume expansions up to 1000% are possible. Uniform decomposition of "Unicel" ND at a practical temperature range is assured by activators incorporated into the plastisol.

"Unicel" ND has excellent stability under normal conditions. When heat is applied, it decomposes smoothly and rapidly to form nitrogen and a solid residue. Why not find out for yourself how "Unicel" ND can help in *your* manufacturing program?

FOR MORE INFORMATION send in the coupon below for Technical Service Bulletin No. 5. Our technical and engineering staffs will be glad to advise you on specific applications of "Unicel" ND. Just write: E. I. du Pont de Nemours & Co. (Inc.), Chemical and Miscellaneous Sales, Explosives Dept., Nemours Bldg., Room 2539, Wilmington 98, Delaware.

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. . . THROUGH CHEMISTRY

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Wilmington 98, Delaware.

Please send me Technical Service Bulletin No. 5 which describes "Unicel" ND in detail.

Name_____

Position_____

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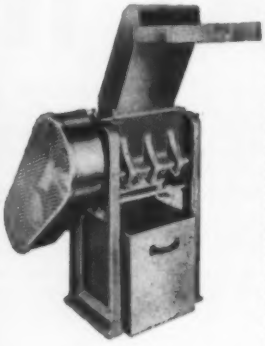
Save time, money, storage space with—

DE MATTIA GRANULATORS

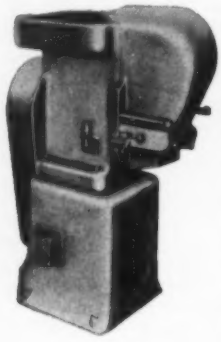
PROCESS ALL YOUR SCRAP

GRANULATOR No. 1



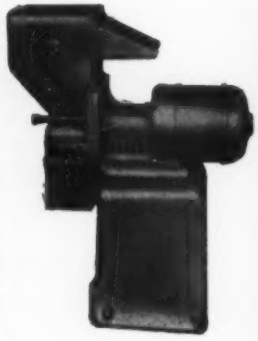
Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Mechanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with ¼" openings (other screen sizes on request). Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.

GRANULATOR No. 3



For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order).

GRANULATOR No. 4



Recommended for at-the-machine operation. Available with or without base. Capacity 75 lbs. per hour; 2 H.P. Motor 1200 RPM; Direct spline drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening; Overall dimensions 34" long, 12" wide, 23½" high (from bench); Hopper opening 9" by 4½"; Net weight 375 lbs. without base; 500 lbs. with base.

DE MATTIA MACHINE and TOOL CO.

CLIFTON • NEW JERSEY

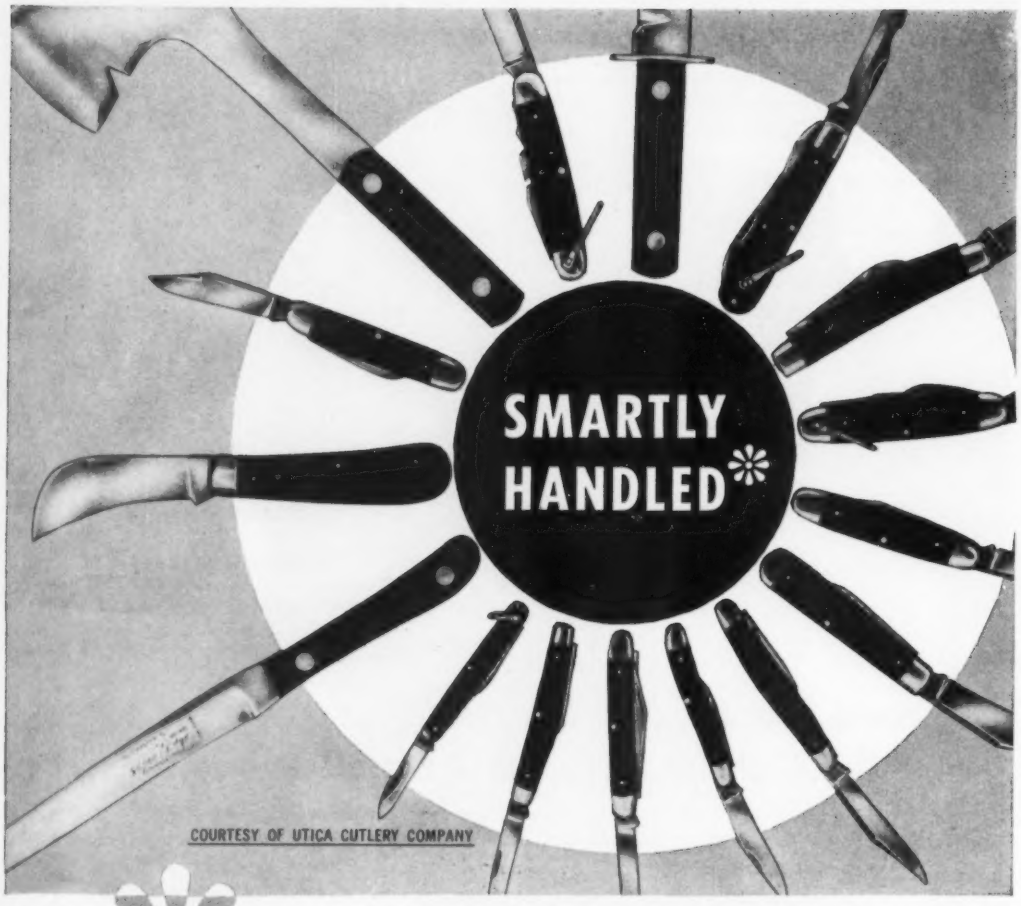
once more . . . "on the nose"

ZENITH in the McDonnell Demon

Rising swiftly from the decks of Navy carriers, McDonnell's new carrier-based jet fighter, the F3H-1 "Demon," is designed to wreak havoc on the enemy. Placed in its prow is another example of rugged ZENITH reinforced plastic construction—the type of product that has brought ZENITH to the forefront in both military and civil R.P.* production. For specific problems in this field, consult the Engineering Division of

R.P.* *Reinforced Fiberglas Plastic*

ZENITH PLASTICS CO. **gardena, calif.**



ROGERS CORPORATION

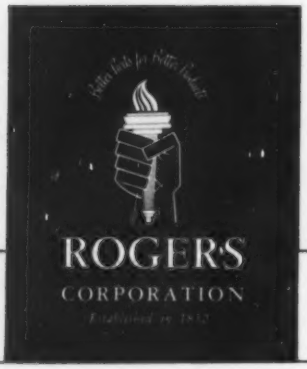
impact phenolics permit high speed production

Rogers impact phenolics fit perfectly into the high speed production molding methods devised by Adams Plastics, Inc., Holyoke, Mass., number one producer of plastics cutlery handles. Here's why:

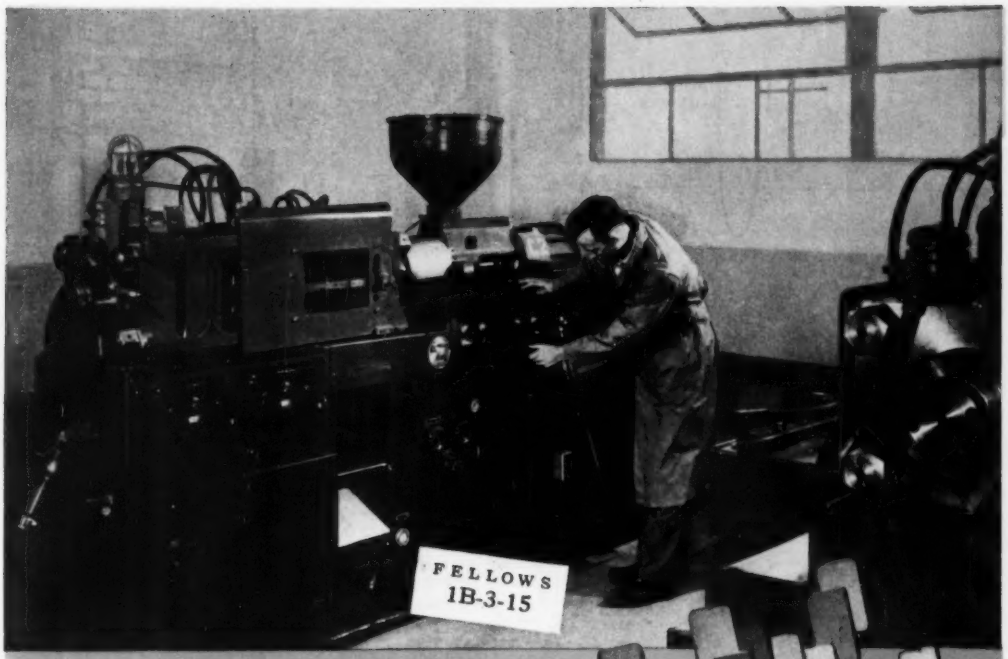
Low bulk factor to strength ratio . . . close weight tolerances can be held in automatic preforming (Adams holds preforms consistently to plus or minus 1%) . . . Uniform pellet size eliminates need for overcharging, assuring thin flash . . . also pours smoothly without agitation . . . excellent flow properties with good cut-off at normal temperatures.

If you need to produce high strength parts economically at high speed, investigate Rogers impact phenolic molding compounds.

Write for technical data to Dept. P, Rogers Corporation, Manchester, Connecticut.



DUROIDS for Gaskets, Filters, Electronics . . .	ELECTRICAL INSULATION for Motors, Transformers, Generators . .	PLASTICS Molding Compounds and Laminates	SHOE MATERIALS for Counters, Midsoles, Liners . . .	FABRICATING Producing parts from Rogers materials



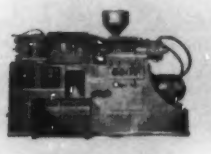
Now...Up to 40 Color Changes in 24 Hours

A Standard Fellows Injection Molding Machine Proves its Versatility In Production Quality Control

One of America's leading plastic materials' manufacturers (probably one of your prime suppliers) has selected the Fellows 1B-3-15 for quality and color control of their molding materials.

The reason? Fellows exclusive "Speed-Flo" design feature gives quality moldings, plus fast purging for more rapid, less costly color changes. And—new set-ups are made with a minimum of down time.

This fast changeover and super-control, coupled with compact design and low maintenance, can make Fellows Plastics Molding Machine your best bet, too. So, if you want quality plus speed, investigate the versatile Fellows 1B-3-15 now!



Fellows
injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2, Michigan • 5835 West North Avenue, Chicago 39, Illinois • 2206 Empire State Bldg., New York 1, N. Y.

When It's Grinding or Pulverizing

STURTEVANT EQUIPMENT

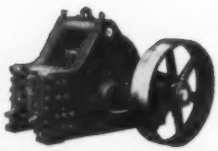
DOES THE JOB FAST!

Whether you grind soft or hard materials, there is a Sturtevant Grinder or crusher exactly suited to your requirements.

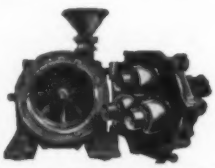
Tough and rugged, Sturtevant Equipment has the built-in stamina to stand up under continuous operation. Most of this equipment has the "open door" accessibility which makes cleaning easy.

Look into Sturtevant Grinders and crushers for your applications. These machines will give you the exact mesh you want . . . cut your costs by increasing production. Write for catalog today.

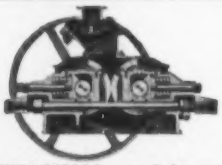
ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.



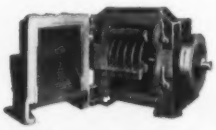
JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.



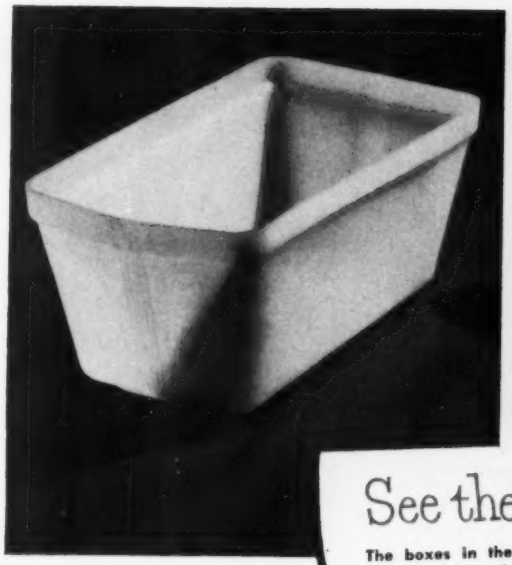
SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

MOTO-VIBRO SCREENS screen anything screenable. Classified vibrations. Unit construction—any capacity. Open door accessibility. Open and closed models with or without feeders. Many types and sizes—range of work ½" to 60 mesh.

STURTEVANT MILL COMPANY

110 CLAYTON STREET, BOSTON 22, MASS.

DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS



See the difference!

The boxes in these unretouched photographs were molded under the same conditions and exposed to a temperature of 212°F. The box on the left, made from Koppers MC 409, showed little or no distortion after 30 minutes at this temperature. The box on the right, made from a widely used commercial modified polystyrene, showed major distortion within 10 minutes.

high heat resistance in a modified polystyrene . . .

KOPPERS MC 409

● Here's the high-heat modified polystyrene that the industry has long wanted . . . Koppers MC 409.

This new material combines three important advantages . . . higher heat resistance *(up to 198°F.*)* . . . the toughness and shock resistance of modified polystyrene . . . and the desirable finish and molding characteristics of regular polystyrene. MC 409's excellent heat resistance is comparable to that of Koppers well known Polystyrene 8.

These qualities make MC 409 an ideal material for radio cabinets, battery cases, washing machine and refrigerator parts, toys, housewares, brush handles and, in fact, any molded or extruded polystyrene product subjected to heat.

Koppers MC 409 makes possible sturdy, shock resistant, plastic products that withstand the high temperatures found in show windows, dishwashers and automobiles, where other modified polystyrenes sag and shrink. Tests prove that on exposure to boiling water MC 409 will show low deformation with a minimum of shrinkage.

FOR FREE SAMPLES for testing in your laboratory and for Technical Bulletin C-2-161-TR describing the properties and characteristics of MC 409, write, wire or phone Koppers Company, Inc., Chemical Division, Dept. MP-122, Pittsburgh 19, Pa.

**A.S.T.M. D-648-45T.*

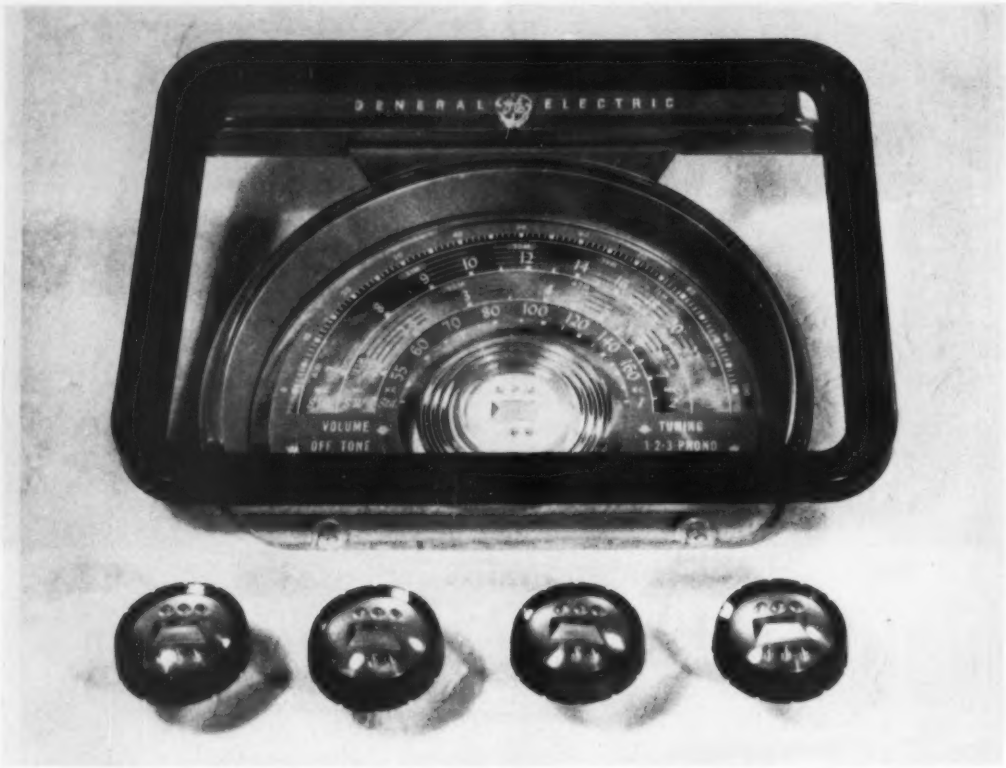
KOPPERS ®

Koppers Plastics Make Many Products Better and Many Better Products Possible

Koppers Plastics

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-122, PITTSBURGH 19, PA.

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · CHICAGO · DETROIT · LOS ANGELES



The above photograph illustrates several parts produced for GENERAL ELECTRIC, for radio cabinet assembly. They consist of an outer escutcheon molded in opaque polystyrene; an inner escutcheon molded in clear, decorated in white and gold; dial scale molded in clear material, silk-screened with calibrations and copy; and a knob made of two pieces with the center lens section inserted in the opaque body. This complete set of parts is fitted into the front panel of one of GENERAL ELECTRIC's export models.

Our engineering staff is at your service in the development of your plastic problems whatever they may be.

CRUVER
Manufacturing Company
2460 W. JACKSON BLVD. CHICAGO 12, ILLINOIS
MOLDING • FABRICATING • LAMINATING • FINISHING
PIONEERS IN PLASTICS SINCE 1896
"BAS RELIEF" DECORATING • ASSEMBLY • SPRAYING

Branch Offices: DAYTON • DETROIT • MINNEAPOLIS • NEW YORK • PHILADELPHIA • SYRACUSE

Golden Slippers . . . vacuum-engineered for sales

Coty, Inc. hit upon a swank display idea for its famous perfumes, "Emeraude" and "L'Aimant de Coty": Why not send them to market in golden slippers?

Result? What you see in the picture—beautiful slippers made of reclaimed plastic with an untarnishing coat of aluminum that is overcoated with transparent yellow lacquer to look more golden than gold itself.

This delicate skin of shining metal was applied by Vacuum Metalizing Corporation of Long Island City, New York, using high vacuum equipment developed by DPi.

In this mass production process, vaporized aluminum condenses on the lacquer-dipped plastic moldings to form a solid metallic film only 5 millionths of an inch thick. (It takes only a few snips of aluminum wire to coat a great many slippers.) The topcoat of lacquer protects the metal film and provides the gold or other metallic color effects, if desired.

DPi's experience in high vacuum metallizing techniques and associated lacquering operations, opens an almost limitless range of profit-making possibilities for plastics molders—decorative items such as nameplates, escutcheons, costume jewelry, buttons; toys; fabrics; engineering components like electrical capacitators; and so on, almost without end.

We would welcome a chance to discuss specific vacuum metallizing applications with you. Meanwhile, for a copy of the above data sheet describing DPi coating equipment, write ***Distillation Products Industries,*** Vacuum Equipment Department, 779 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company).

DPi

high vacuum research and engineering

Also . . . vitamins A and E . . . distilled . . . more than 3500 Eastman Organic Chemicals for science and industry

STRONG at the FINISH

when you use Waterproof Cloth Abrasive Belts by CARBORUNDUM

At the finish—where rejects can turn profit into loss—is where you can rely on Waterproof Cloth Abrasive Belts by CARBORUNDUM. Leading plastic molders do just that, for they know these belts are especially developed for wet sanding of plastics and other ductile materials subject to plastic flow.

In five important ways, Belts by CARBORUNDUM are outstanding. They're built with just one aim in view—to give you a better finish, in greater volume, at lower cost.

Week after week, more and more custom molders are making a trial test of Waterproof Cloth Abrasive Belts by CARBORUNDUM—and are permanently convinced. How about you? Why not call in the CARBORUNDUM man or distributor salesman today?

- **Smooth-running splices—no "splice throb" to cause breakage**
- **Pre-stretched resin-filled cloth backing—high resistance to "wet-stretch"—less down-time for tension adjusting**
- **Clean, fast, cool cutting action—pre-buff finishes in record time**
- **Hard, sharp silicon carbide grain—high, continuous cutting rate**
- **Long, wear-resistant belt life**

DON'T OVERLOOK another output-booster by CARBORUNDUM: the Vonnegut Brush-Backed Sander Head, designed specifically for finishing contours, curves and other irregular plastic surfaces. Cushioned wiping action generates a satin finish, readily buffed out. Effectively blends surface irregularities. Cool, clean cutting produces a finer, more uniform finish with less operator effort. Ask the CARBORUNDUM representative for details, or write Dept. MP 82-53R.

Only CARBORUNDUM

TRADE MARK

offers ALL abrasive products ...to give you the proper ONE

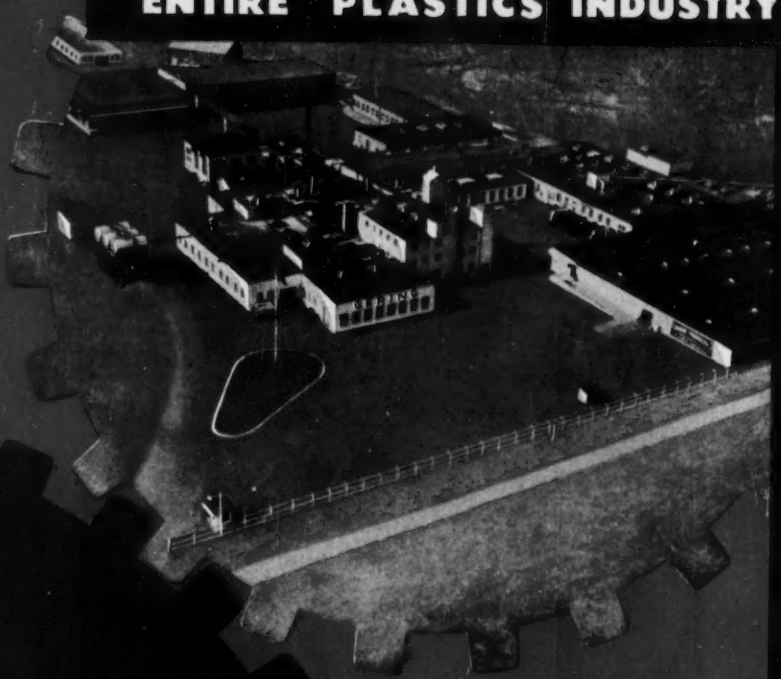
82-53

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York.

Gering is Geared TO SERVE THE ENTIRE PLASTICS INDUSTRY

a complete **PLANT**

for a complete **SERVICE**



WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.

- **WE BUY THERMOPLASTIC SCRAP** — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
- **WE CUSTOM COMPOUND** your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
- **WE EXTRUDE** any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.

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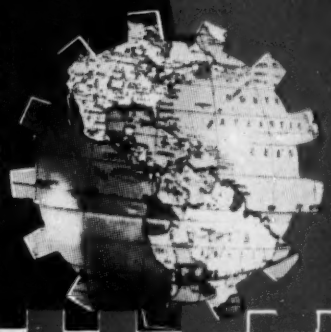
—offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.

Our service is world-wide . . . attained over the years thru eternal self-discipline for Quality, Perfection, Delivery. Consult our Technical Service Department.



Our 30 years expert know-how and large facilities. Your guarantee of complete satisfaction

GERING *Products* INC. KENILWORTH, N. J.

Another new development using

B. F. Goodrich Chemical *raw materials*

Data courtesy of General Electric Chemical Division, Pittsfield, Mass. Meters manufactured by Weston Electrical Instrument Corp., Newark, N. J. B. F. Goodrich Chemical Co. supplies the Hycar rubber only.

Hycar "clicks" in solving trigger breakage problems!

BREAKAGE of units or parts can often be overcome easily when a Hycar rubber-phenolic compound is used—just as it was for the trigger of the volt-ammeter pictured.

Formerly, the triggers were molded of conventional rag-filled phenolic compound. Sudden pressure on the trigger sometimes caused breakage. When a Hycar-phenolic compound was substituted, breakage dropped to the vanishing point.

Hycar also helped the manufacturer make additional savings. Costs were reduced because hand preforming and finishing operations are no longer required.

Hycar-phenolic compounds are noted for their exceptional shock-resistance—5 to 10 times that of conventional phenolic compounds. Hycar imparts extra toughness that enables molded parts to withstand more abuse.

They simplify operations, too. In processing, they provide better molding characteristics . . . easier flow in the mold than straight phenolics . . . resistance to cracking around metal inserts in the part.

One of the many Hycar rubber compounds may help you solve a product problem and cut costs. Versatile Hycar is used as a base material . . . as a modifier for phenolic resins . . . as an adhesive base . . . as a latex for coating or impregnating. For technical advice, please write Dept. HU-6, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
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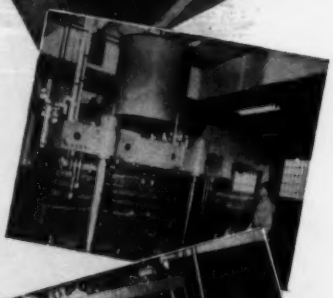
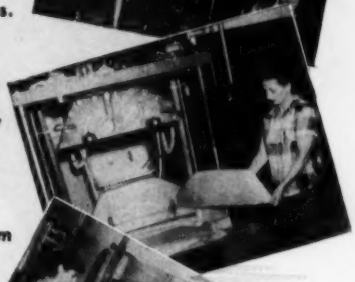
Hycar
American Rubber

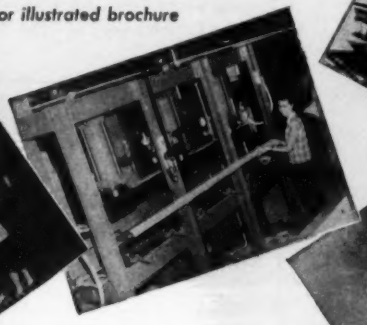
GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

It takes more than PRESSES

TO MAKE GOOD REINFORCED LAMINATES







And we have what it takes. At Russell, before a new part enters a press, you can be sure that it has been carefully diagnosed . . . that skilled chemists and engineers have worked in harmony to approve the base material, the resins, the technique and the timing.

It's the study we give to a part *before* production that saves us time later, saves you money and makes rejects virtually unknown in our plant.

Only then are presses important. And again, we have what it takes. Except for our battery of small presses, the largest in America, all our equipment is widely diversified . . . not ordinary all-purpose presses but ones designed by us specifically for reinforced laminates . . . unique in the industry. These range from presses with a capacity of 80 tons pressure to more than 1,200 tons . . . from those with 24" of daylight to others of 66" and 75". . . from machines that produce one complex part to one that will turn out fifteen 4' x 9' flat sheets at a time . . . or a press that will make a part 13' long. Our 48" Preform is an important adjunct in preparing parts for our larger presses. When you need "what it takes" to solve your problem in reinforced plastics, save time by consulting Russell first.

Write for illustrated brochure

Repco Plastics by Russell

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AIRCRAFT SPECIALTIES CO., INC. • Hicksville, L.I., N.Y.
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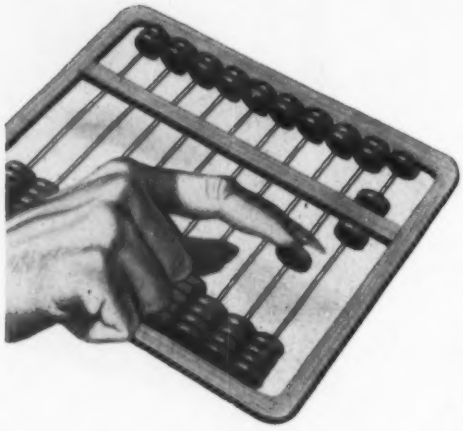
GLADWIN PLASTICS, INC. • Atlanta 3, Georgia
ALLIED PRODUCTS ENGINEERING CO. • Los Angeles 43, Cal.
WESTERN FIBERGLAS SUPPLY CO. • Los Angeles, San Francisco, Seattle

Any way you figure it...



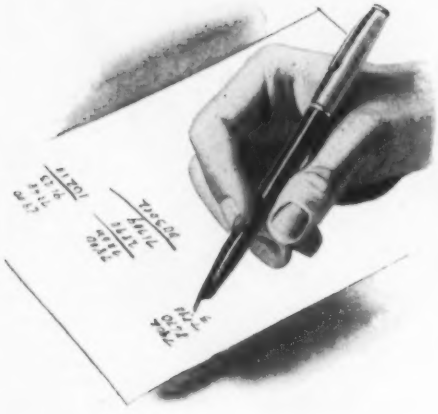
It's the FINISHED COST that counts!

SURFEX® MM can give your vinyls all these advantages—at no greater cost than for water-ground limestone:

- **BETTER LIGHT STABILITY**
- **REDUCED MIXING TIME**
- **LESS WEAR ON DIES**
- **CONTROLLED CHEMICAL ANALYSIS**
- **LOW IRON CONTENT**

Check the pound/volume comparison at right to see how SURFEX MM, a controlled quality precipitated calcium carbonate, can help you lower vinyl compounding costs and increase batch yields with no sacrifice in quality.

Write for your copy of "The Application of Inert Fillers in Vinyl Plastics".



YOU GET ALL OF SURFEX MM's ADVANTAGES AT NO EXTRA COST

	COST/LB	RECIPE	
PVC RESIN	$0.38	100	100
DOP	.42	57	57
SURFEX MM	.0185	35	—
W-G Limestone	.009	—	34
Stabilizer	.57	3	3
Lb./Volume Cost	—	45.2c	45.2c
Durometer Hardness	—	85	85
Tensile	—	2400 psi	2200 psi
Crescent Tear	—	400 lbs/inch	350 lbs/inch

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also, representatives in other principal cities.

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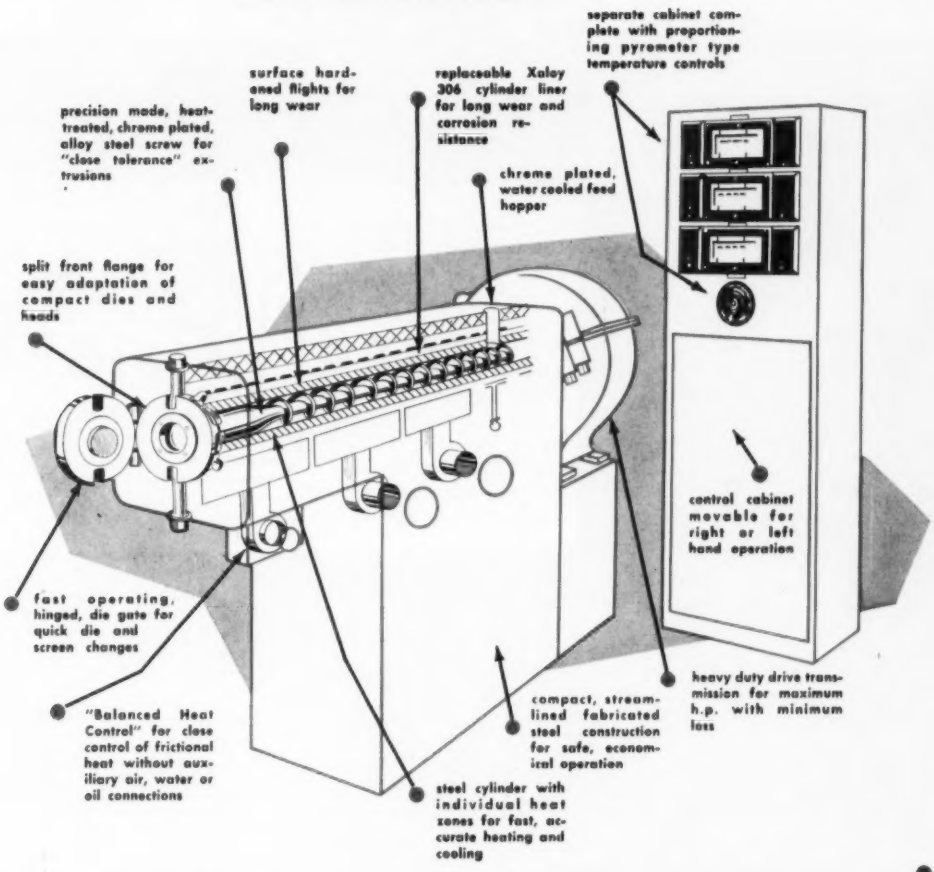
DIAMOND SURFEX FOR BETTER VINYLS

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS ®

Here's Why NRM is first choice . . .


separate cabinet complete with proportioning pyrometer type temperature controls
surface hardened flights for long wear
replaceable Xaloy 306 cylinder liner for long wear and corrosion resistance
precision made, heat-treated, chrome plated, alloy steel screw for "close tolerance" extrusions
chrome plated, water cooled feed hopper
split front flange for easy adaptation of compact dies and heads
control cabinet movable for right or left hand operation
fast operating, hinged, die gate for quick die and screen changes
"Balanced Heat Control" for close control of frictional heat without auxiliary air, water or oil connections
compact, streamlined fabricated steel construction for safe, economical operation
heavy duty drive transmission for maximum h.p. with minimum loss
steel cylinder with individual heat zones for fast, accurate heating and cooling

Among plastics extruders the world over

In 1940, NRM gave you the first extruder specifically designed for thermoplastics. Today, NRM is the leading supplier of extruders to plastics fabricators throughout the world. The reasons are obvious. They are the many "firsts" and the many features you'll find incorporated in NRM extruders. Write, today, and let us describe them in detail for you.

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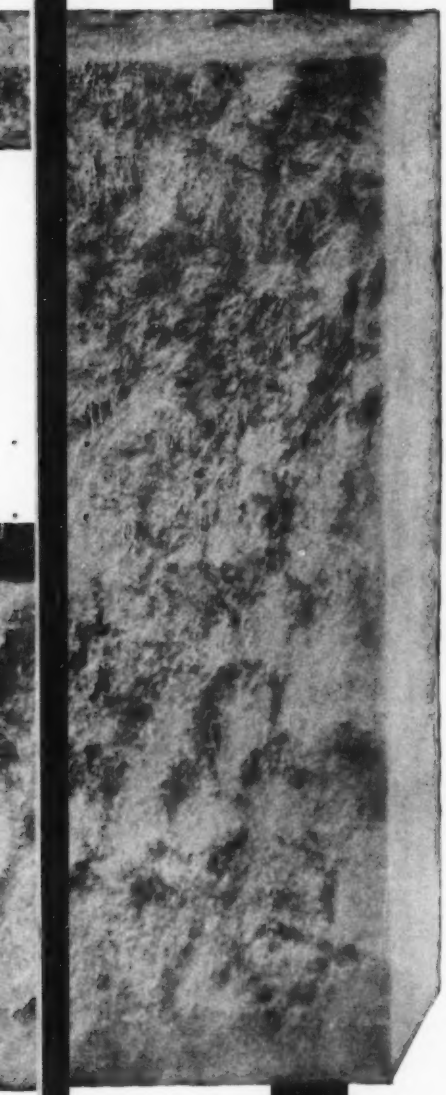
FIBER PPG GLASS

Now!

Pittsburgh Plate Glass Company makes FIBER GLASS

On October 1, 1952, Pittsburgh Plate Glass Company began the production of Fiber Glass at its new plant at Shelbyville, Indiana. All of the technological and mass production experience acquired in sixty-nine years of glassmaking are being devoted to the volume manufacture and further development of this wonder fiber . . . to assist in its greater utilization by industry.



Highlights

OF THIS NEWEST FIBER GLASS OPERATION

PLANT LOCATION—Shelbyville, 27 miles Southeast of Indianapolis, is served by the Pennsylvania and New York Central railroads. The location presents numerous advantages to many users of Fiber Glass.

PRODUCTION FACILITIES—The most advanced manufacturing processes and techniques are being employed to assure the production of Fiber Glass which meets the most exacting standards and requirements.

PRODUCTS—Two basic forms of Fiber Glass, each in a full range of grades and sizes, are being produced:

SUPERFINE INSULATION—Composed of fibers of exceptional fineness—from 3 to 20/100,000 of an inch in diameter—providing greatest thermal and acoustical insulating efficiency-to-weight ratios, extraordinary strength, compressibility and resiliency. In all standard grades and sizes, or fabricated to specifications.

YARNS, STRANDS AND ROVING—Continuous filament fiber, twisted and plied to provide yarns of the weights and types required for electrical insulation and industrial and decorative fabrics. Roving, composed of continuous filament strands, bundled in parallel, and chopped strands, consisting of roving cut to lengths of ½" to 2", for use in plastics.

TECHNICAL ASSISTANCE—A staff of trained engineers is available to lend technical assistance in utilizing PPG Fiber Glass to maximum advantage in all applications, particularly those involving new fabricating methods and products.

RESEARCH AND DEVELOPMENT—A program of continuing research and development is established for the purpose of giving users of PPG Fiber Glass every future advantage, from refinements in manufacture to benefits in utilization.

The Unique Properties of
***PPG FIBER GLASS** Help Make*
Products ***BETTER,***
SAFER, LIGHTER, STRONGER

You may be able to realize important advantages in using PPG Fiber Glass. For additional information, please contact Pittsburgh Plate Glass Company, Fiber Glass Division, 632 Duquesne Way, Pittsburgh 22, Pa. . . . or district sales offices in Chicago, Detroit, New York, Washington . . . or the nearest PPG Warehouse.

FIBER PG GLASS **PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS**

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See us at Booth 1401, ASTE Show, Chicago, March 17-21, 1952.
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SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES
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first name in special purpose steels
TOOL STEELS
52 years of Fine steelmaking
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You see this ad in Tool Engineer, Machinery, Modern Machine Shop, American Machinist, Iron Age

and our

MOLD STEEL *is* TOOL STEEL

Our reputation was built on tool steel . . . and that means that when Crucible puts mold steel in the same class as tool steel — *you* benefit!

You benefit these ways: we've assigned an experienced metallurgical staff to help you with your plastic mold problems; we back every pound of steel with over 50 years of specialty steel leadership, and we have stocks available from warehouses strategically located from coast to coast.

Crucible mold steel *is* better. It's tool steel.

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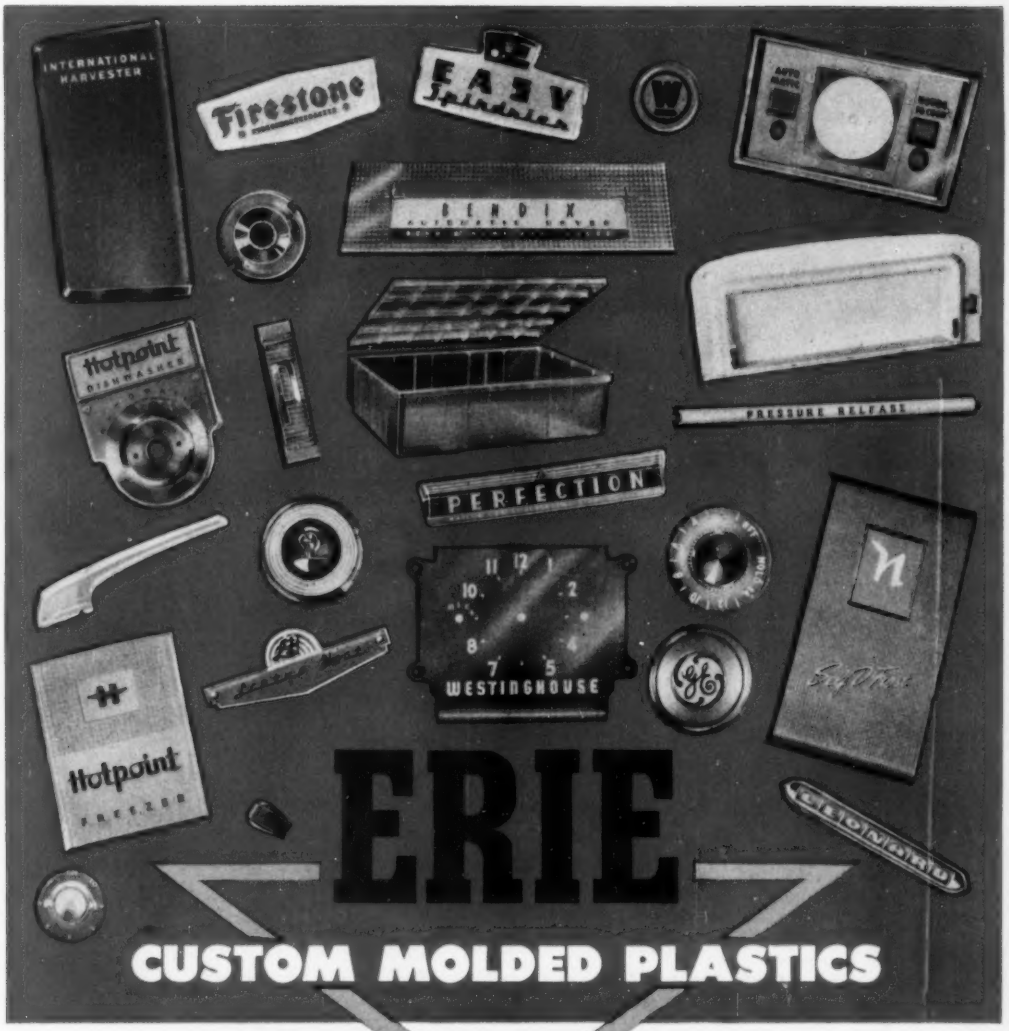
Get your copy of the unique Crucible Tool Steel Selector — a quick twist of the dial gives you the right tool steel for the right job. And will help in the selection of mold steel. Selector has 9-inch diameter; printed in 3-colors.

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

MOLD STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.



for Electrical Appliances

Electrical appliances cover a wide range of domestic utility products . . . and Erie covers just as wide a range in custom molded plastic components. Whether it's a three dimensional plate that will at once identify your product and distinguish it—a hidden part upon whose perfect functioning depends the performance of the machine—a conspicuous knob or control which should combine utility with beauty—you will find an appreciation of your problems and an unusual ability in helping to solve them, when you come to Erie for injection molded parts.

Write for your copy of bulletin, "Who We Are . . . What We Do in Plastics."

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Announcing—

an OUTSTANDING, NEW Plasticizer

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plasticizer CC-55

[di(2-ethylhexyl) hexahydrophthalate]

...a general-purpose plasticizer with "ACROSS-THE-BOARD" utility

- FLEXOL CC-55 is a primary plasticizer for the vinyl chloride resins and for many coating resins and polymers.
- It's a plasticizer for all major vinyl-plastic compounding—for calendered and extruded goods, for plastisols and organosols, and for coatings.
- Excellent heat and light stability make CC-55 equally advantageous for clear and pigmented vinyl products.
- Good low-temperature properties and resistance to water extraction.
- Excellent electrical properties.
- Water-white color.

You can count on the availability of CC-55, because it is made 100% from basic CARBIDE raw materials. Find out about this new plasticizer today. Ask any Carbide and Carbon office for the technical bulletin, F-7893A, or simply fill out and mail in the coupon.

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☐ Technical bulletin on FLEXOL plasticizer CC-55
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Your products strike a proud and pleasing note in zephyr weight,—smash proof ~~MILLS PLASTIC~~ bottles.

Their elegance enhances luxury products—they add prestige appeal to mass merchandise in either your custom design bottles or in standard Mills OBLONG or Mills CYLINDER bottles. And the new SPRAYKAP—with no parts to lose—affords simplest assembly and easiest dispensing.

Let your present and prospective products look and sell their best in ~~MILLS PLASTIC~~ bottles. Today's inquiry on your letterhead can help increase tomorrow's sales.

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Admiral 21" TV Cabinet molded by

Bigger Screen...

Bigger Cabinet...

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In developing the *first* plastic television cabinet, **MPc** initiated a plastics industry trend toward big-piece molding. To potential users of large plastic moldings, **MPc** offers an unparalleled fund of experience...unmatched facilities...and the enterprising spirit that welcomes the challenge of new problems. You are invited to consult with **MPc** engineers regarding your plans or product. Write to Molded Products Corporation, 4535 W. Harrison St., Chicago 24, Illinois.

PLASTICS DIVISION
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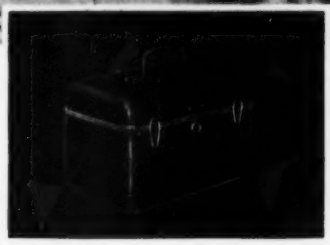
...Pace-Makers in Plastics Molding

FREE "Data Book of MPc Facilities," an engineering-eye view of MPc press capacities and other production facilities...together with a survey of MPc special skills available for your use. Write for your copy.

"Samsonite" ladies' train case by Shwayder Brothers, Inc., Denver, Colo.



Shock Absorbers for hard-riding luggage

Luggage takes its worst beating around the edges and corners. The handle – pulling, lifting, swinging all the weight – gets the most strain.

That's why Samsonite – famous for durable luggage – gives this ladies' train case a binding and handle of VINYLITE Elastomeric Plastic.

Notice how the VINYLITE Plastic binding is molded to fit, then stitched fast, giving smooth, wrinkle-free edges and corners. The one-piece flexible handle makes heavy loads easier to carry, won't come apart.

VINYLITE Elastomeric Plastics stay tough and flexible, won't dry out, crack, or lose shape. They're light in weight, have good electrical properties. They'll resist water, oils, alkalies, most strong acids. A damp cloth keeps them clean. They come in a wide range of colors that won't fade, and they can be readily molded or extruded to intricate shapes.

Wire coatings, garden hose, refrigerator door gaskets, vacuum cleaner bumpers made of VINYLITE Elastomeric Plastics demonstrate some of their design and functional possibilities. Scores of other defense and industrial applications prove their usefulness.

Learn more about them and about molding compounds of BAKELITE polyethylene, polystyrene, and phenolic plastics. Write Dept. OG-7.

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Always looking for something new

— these millions of home-improving families with

BUY ON THEIR MINDS!

THE best customers for all products which go into homes are always those people who are eager for something new, something better. And that is an accurate description of the 3½-million men and women who read Better Homes & Gardens!

Which is not surprising when you consider that every issue of BH&G is full of practical ideas on how to improve the home—and what to BUY to do the job.

This means that every reader goes through BH&G, *expecting* to find better things to BUY. And what could be a better place to have an ad on plastics!

BH&G BUYOLOGICAL BRIEFS

- *A PLASTICS COMPANY AD for home demonstrations pulled 5,000 BH&G family responses.*
- *ONE BH&G AD BROUGHT a plastics manufacturer 12,172 dimes for a sample he offered.*
- *OVER 3,000,000 BH&G FAMILIES are in the market for plastic kitchen canister sets.*

MEREDITH PUBLISHING COMPANY, Des Moines, Iowa

. . . with Plasticizers made by a Basic Producer

You're ahead from the start in your plastics formulations when you call on Pittsburgh Coke & Chemical for your plasticizers. For as a *basic* producer, we can offer you three important benefits: (1) Consistent uniform plasticizer quality —regardless of whether you buy in single drum lots or by the carload. (2) A broad family of plasticizers from a single, *basic* source of supply. (3) Fast, efficient shipments, backed up by dependable, continuing supplies. So when you're specifying plasticizers, get the details on PX Plasticizers *first.* You'll find it pays, *in every way,* to buy plasticizers from a basic producer. ● Don't hesitate to write or call for samples, specification sheets or any technical assistance you may need.

PX-104	DiButyl Phthalate
PX-108	DiIsoOctyl Phthalate
PX-109	DiNonyl Phthalate
PX-138	DiOctyl Phthalate
PX-208	DiIsoOctyl Adipate
PX-209	DiNonyl Adipate
PX-238	DiOctyl Adipate
PX-404	DiButyl Sebacate
PX-408	DiIsoOctyl Sebacate
PX-438	DiOctyl Sebacate
PX-658	TetraHydroFurfuryl Oleate
PX-917	TriCresyl Phosphate

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COKE & CHEMICAL CO.

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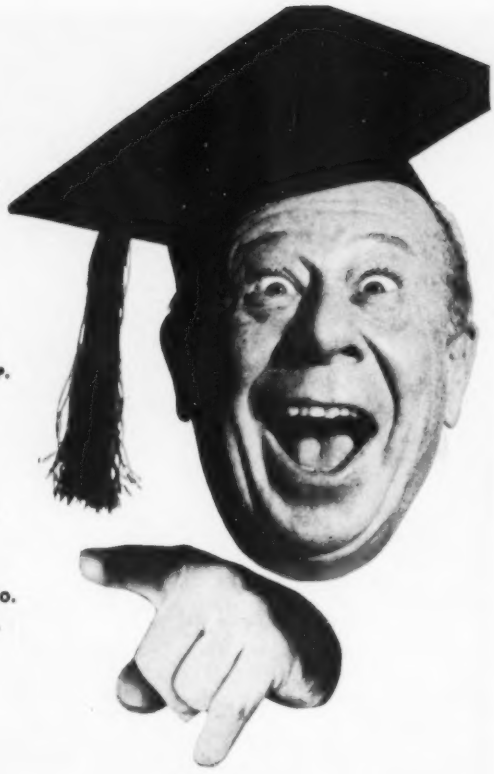
Q.

Which of these 23 firms can reduce your costs—increase your sales?



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A. *All of them . . . because all of them make Phillips Cross-Recessed-Head Screws*

Your customers recognize these nationally advertised fasteners as the clue to quality. Millions of readers of The SATURDAY EVENING POST are being constantly reminded that "X marks the spot." So, they're looking for Phillips Screws on the products they buy. That means extra sales for you.

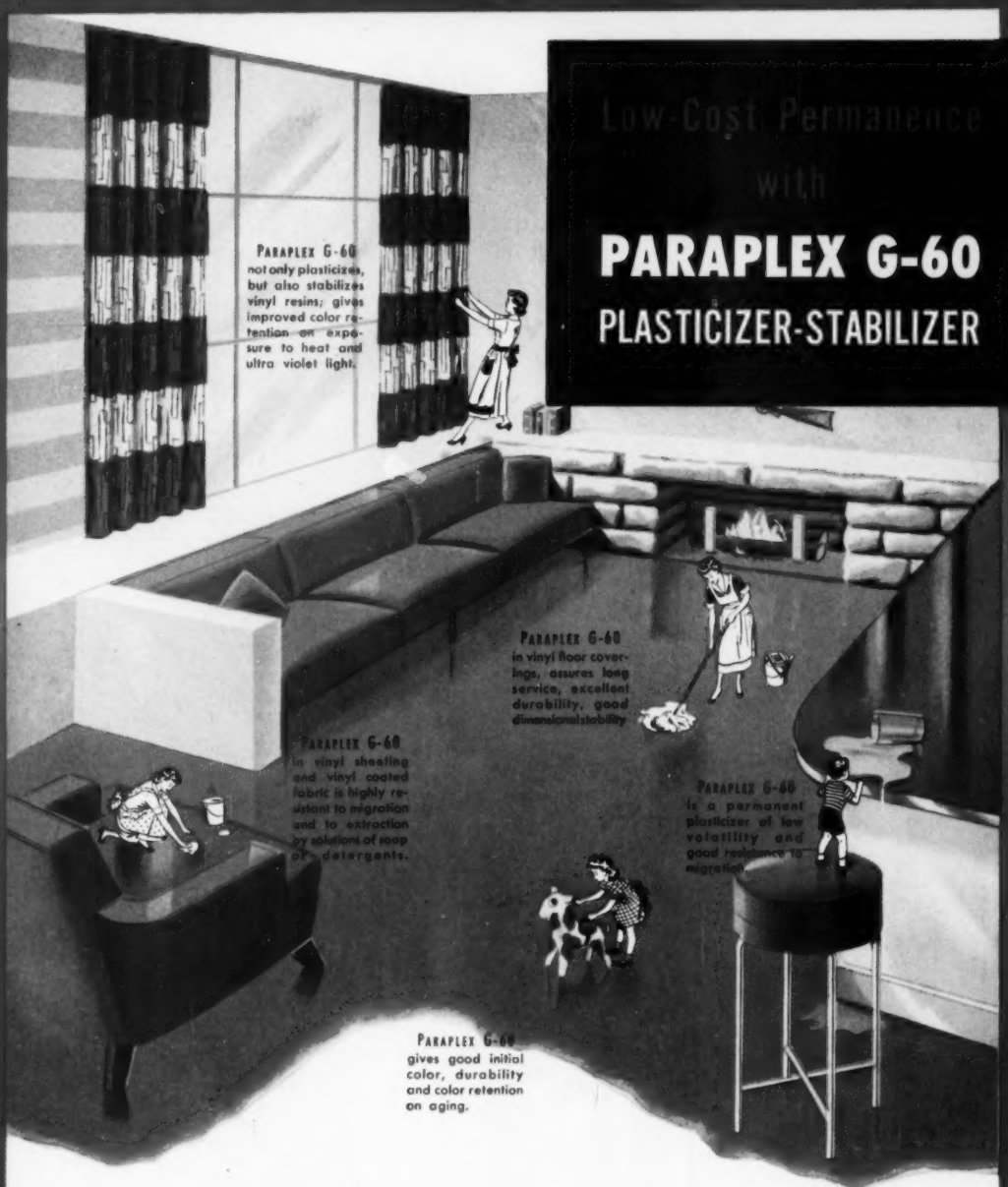
And that's not all. You save time, work, and money with Phillips Wood, Machine, Tapping Screws or "Sems." They save up to 50% driving time, set up tighter, reduce damage due to slippage. Use them more . . . and get more sales.

X marks the spot . . . the mark of extra quality

PHILLIPS *Cross-Recessed-Head* **SCREWS**

As Advertised in The Saturday Evening **POST**

THE FASTENERS OF TODAY . . . AND OF THE FUTURE


Low-Cost Permanence
with
PARAPLEX G-60
PLASTICIZER-STABILIZER
PARAPLEX G-60 not only plasticizes, but also stabilizes vinyl resins; gives improved color retention on exposure to heat and ultra violet light.
PARAPLEX G-60 in vinyl floor coverings, assures long service, excellent durability, good dimensionalstability
PARAPLEX G-60 in vinyl sheeting and vinyl coated fabric is highly resistant to migration and to extraction by solutions of soap or detergents.
PARAPLEX G-60 is a permanent plasticizer of low volatility and good resistance to migration
PARAPLEX G-60 gives good initial color, durability and color retention on aging.

PARAPLEX G-60 is a polymeric plasticizer and stabilizer for vinyl resins. It readily meets processing requirements in rigorous, high speed, high temperature schedules—has the permanence needed in virtually every vinyl application. Cost is low. For a convincing demonstration, ask for a sample of PARAPLEX G-60.

For general use or specialties, one of the PARAPLEX or MONOPLEX plasticizers should meet your needs. Write for this 43-page plasticizer manual.

CHEMICALS FOR INDUSTRY

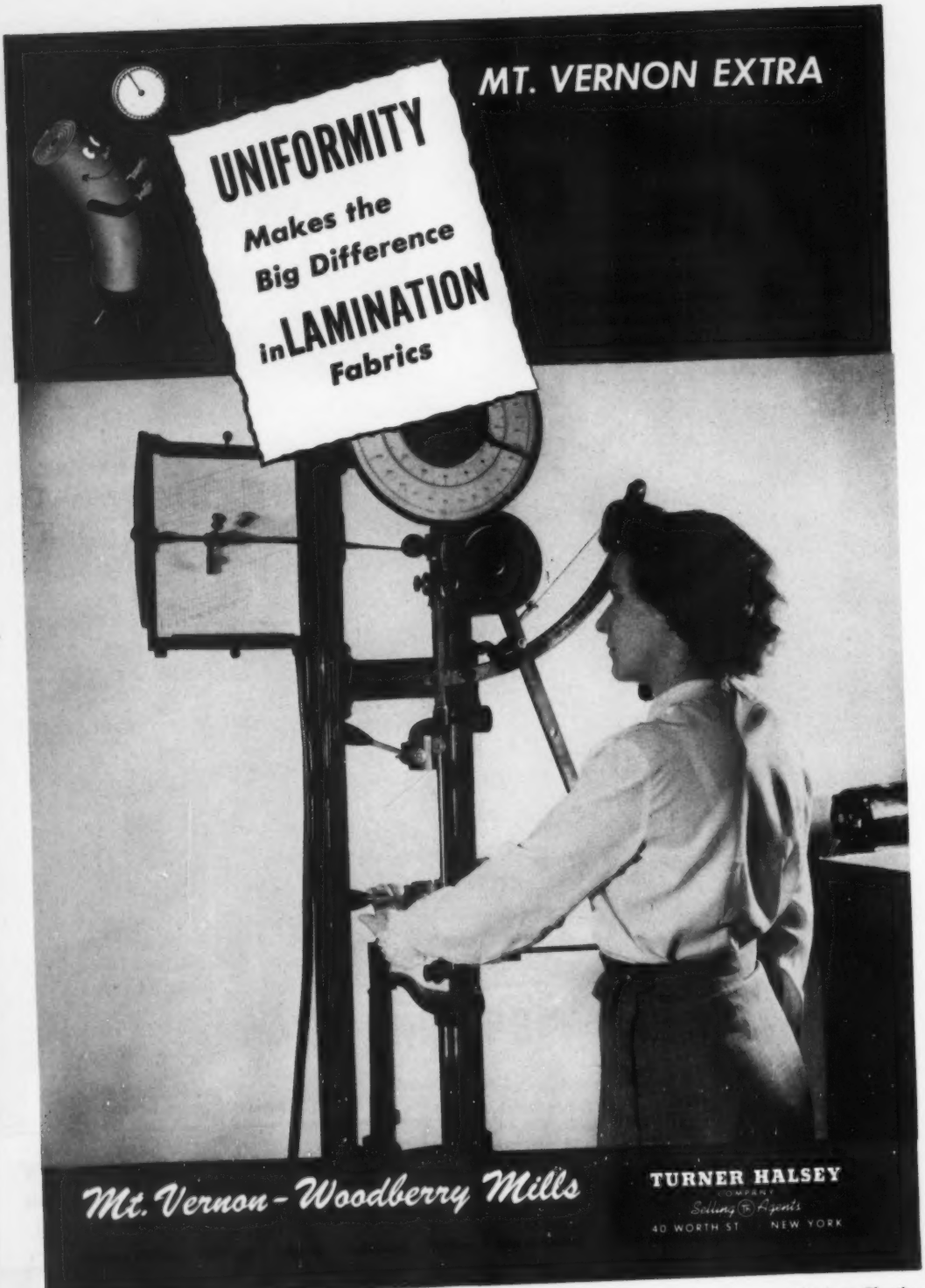
ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

PARAPLEX, MONOPLEX *are trademarks, Reg. U. S. Pat. Off. and in principal foreign countries.*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UNIFORMITY
Makes the
Big Difference
in LAMINATION
Fabrics
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40 WORTH ST NEW YORK

First again!

One-piece, injection-molded Battery Case by GENERAL AMERICAN

strong!

greater cell volume–longer life!

light! (8⅗ lb.)

For the first time, a one-piece, injection-molded battery case becomes standard equipment for jet planes.

The engineering and unusual mold design enable General American to produce this one-piece molding with no taper on the outside and minimum taper on the inside.

Weighing 8⅗ lb. (compared with more than twice that weight for other materials) this jet battery case has greater cell volume, longer life and higher electrical ratings.

General American's Plastics Division is one of the most modern and versatile molding sources in the industry with injection presses ranging up to 300 oz. and compression presses up to 2000 tons. A complete source, from development to delivery . . . *with facilities unduplicated anywhere!* Why don't you find out about them right now? Write for our new brochure.

General American has had more than 50 years of successful experience in manufacturing for America's largest companies.

plastics division

GENERAL AMERICAN TRANSPORTATION CORPORATION

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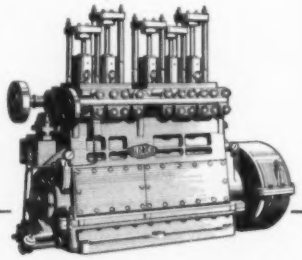
SPEED ADVANCEMENT

Aldrich did it with Direct Flow Pumps

Not too long ago, 150 rpm was considered high speed operation for reciprocating pumps. But today—as a result of improved design and stronger metals—Aldrich Direct Flow Pumps are operating efficiently at *or over* speeds of 500 rpm for the 3″, 360 rpm for the 5″, and 300 rpm for the 6″ stroke unit. This increase in speed means simply this:

You get more work—greater pressure and volume—out of a smaller pump. You invest in a lighter, lower cost unit . . . a pump with a *sectionalized* fluid-end that's extremely easy to maintain and which can be made of stainless steel, bronze, Monel or other special material, as desired.

To meet your molding, extrusion, and other needs involving hydraulic pressure, Aldrich can design and furnish your *complete* hydraulic system—incorporating Aldrich Pumps, by-pass valves, controls, accumulators, and control systems. Write for full details.



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...Originators of the Direct Flow Pump

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get in the swim for more sales...

MILMER 1 for mildew control in vinyls

Tubing or fabric coatings . . .
Insulation or film . . .

If it's made of vinyl, it will last longer with Monsanto Milmer 1. Make sure *now*, the vinyl you produce for next summer's market contains this key compound. Milmer 1 controls mildew, enables vinyls to resist attack by fungi, thereby reducing disfiguration, embrittlement or cracking.

And it's easy to use. It can be incorporated readily into tubing, free film or coated fabric. Properly applied, it will not cause crocking, bleeding or blooming. It is nontoxic and permanent.

For more information about Milmer 1 in vinyls—or a listing of military specifications including or requiring Milmer 1—call or write MONSANTO CHEMICAL COMPANY, *Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.*

Milmer: Reg. U. S. Pat. Off.

MILMER 1

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

SEE WHAT IS AVAILABLE AT

Farrel-Birmingham has earned the right to the title of "Calender Headquarters" because it has—

BUILT MORE CALENDERS for processing rubber, plastics, linoleum, asphalt tile and other materials than all other manufacturers combined. In the last few years, the company has made over 100 plastics calenders alone.

BUILT MORE DIFFERENT TYPES OF CALENDERS, including every one represented by the thirty-four diagrams shown on the opposite page.

PIONEERED MORE IMPROVEMENTS IN DESIGN. For example, the Z-type calender which has been specially developed for high-speed production of plastic film and fabric coating. One manufacturer, using a Z-type calender, is able to produce, for the first time on a commercial scale, 1.7 gauge, calendered, unsupported vinyl film. The variation in accuracy of gauge of the final product is less than plus or minus .0001 inch. Other records, equally impressive, have been established by Farrel-Birmingham calenders in other fields.

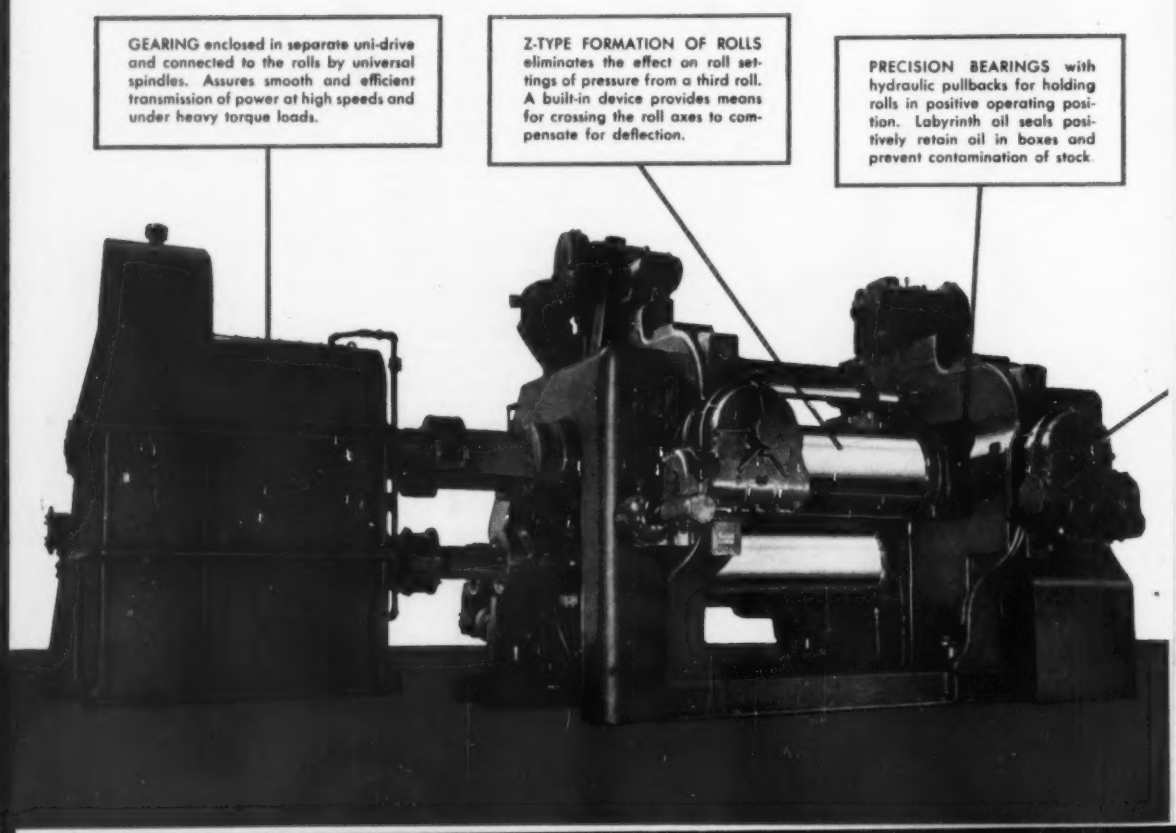
BEFORE YOU DECIDE ON A CALENDER, call in a Farrel-Birmingham engineer. With the experience of "Calender Headquarters" behind him, he will be able to help you find a solution to your calendering problems. In the meantime, send for a copy of Bulletin No. 174 which describes these calenders in detail.

FARREL-BIRMINGHAM COMPANY, INC.

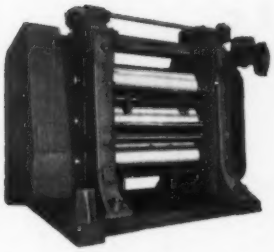
FB-765 **ANSONIA, CONNECTICUT**

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.

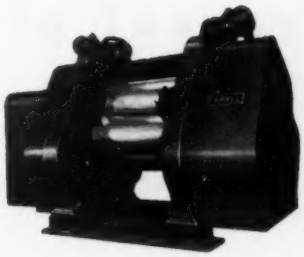
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston


GEARING enclosed in separate uni-drive and connected to the rolls by universal spindles. Assures smooth and efficient transmission of power at high speeds and under heavy torque loads.
Z-TYPE FORMATION OF ROLLS eliminates the effect on roll settings of pressure from a third roll. A built-in device provides means for crossing the roll axes to compensate for deflection.
PRECISION BEARINGS with hydraulic pullbacks for holding rolls in positive operating position. Labyrinth oil seals positively retain oil in boxes and prevent contamination of stock.

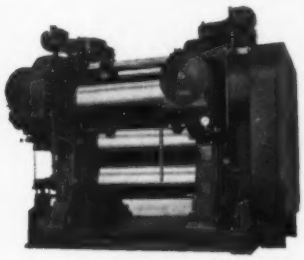
"CALENDER HEADQUARTERS"



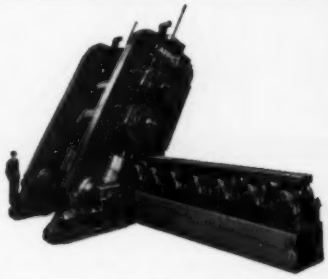
24"x68" three-roll rubber calender equipped with spreader roll, tension roll, knife bar, weighted pressure roll and guides. Windup and letoff are on the other side.



24"x56" special, three-roll, triangular calender for sheeting and coating. Arrangement of rolls facilitates feeding and provides closer control of gauge.



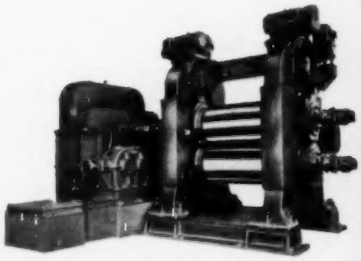
24"x66" four-roll inverted L-type plastics calender with individual motor adjustment on each screw of top and bottom rolls and hand ratchet adjustment for the side roll.



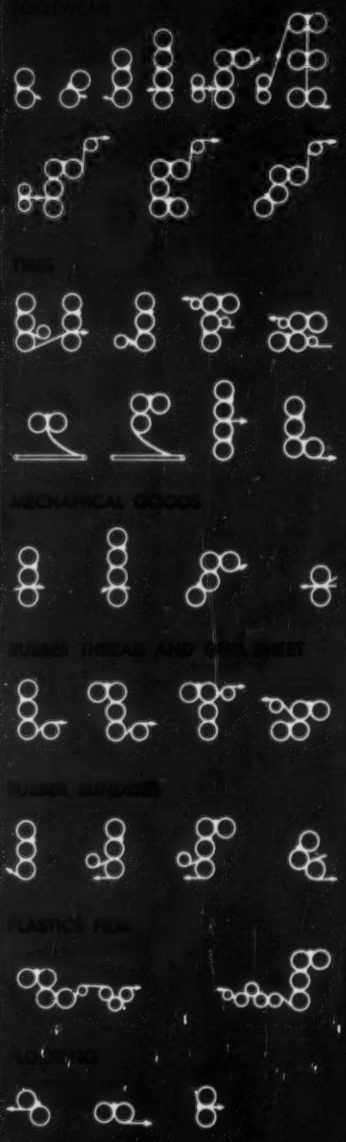
This giant 48"x84" two-roll inclined linoleum calender is the largest in the industry. Because of the great weight of the rolls, a roller table mounted on antifriction bearings is provided for roll removal.

ROLL ADJUSTMENT by individual motor for each screw permits extremely fine adjustment. Pushbutton control provides for adjustment of either roll end separately or both together.

32"x92" four-roll, Z-type calender, specially developed for high-speed, high-precision production of plastic film and for fabric coating.



30"x54" two-roll asphalt tile calender proportioned for great strength and resistance to deflection. Gearing is enclosed in a separate uni-drive.



Farrel-Birmingham®

Eureka!
the universal plastic

It's a thermoset, it's a thermoplastic, it's rigid, it's flexible, it's high pressure, it's low pressure, it's heat resistant, it's red, white and blue, green, black and brown, it's cheaper than sea water.

This universal plastic is super-wonderful. Anyone can mold anything from it at almost no cost. Zoweee! That's progress!!

Unfortunately, it hasn't been invented yet.

At Boonton, we will have to continue hobbling along, just as we have for the past 30 years, balancing application against material, struggling to give each customer his buck's worth and still keep costs down, trying to put plastics where they belong, in the proper manner.

The fact we've kept going as long as we have, even though hampered by the lack of that universal plastic, should prove we know what we're doing. Plenty of others think so . . . Why not you?

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

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specialists in *Reprocessed* plastics

If you use reprocessed plastics, or sell your plastic scrap or have it reprocessed on a contract basis—you can rely on MUEHLSTEIN for superior service, quality and technical "know-how."

MUEHLSTEIN specializes in reprocessed plastics. Their technical staff is at your service.

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PRATT & WHITNEY "KELLERING"

Key to PRECISION MOLDS and DIES FOR BETTER PRODUCTS

Unequalled for

SPEED, ACCURACY, ECONOMY

PHOTO COURTESY OF INTERNATIONAL MOLDED PLASTICS INC., CLEVELAND.

Pratt & Whitney-KELLER Machines are tracer-controlled millers that faithfully duplicate the shape of any master form or pattern. Very complicated shapes are duplicated as easily and accurately as simple work. Molds and dies of every type can be machined much faster than by any other method, and very little hand finishing is required.

The complete P&W-KELLER line includes models to accommodate a very wide range of work sizes. The Type BL — shown above machining the mold for the platter in this quality plastic dinnerware set — is a versatile machine specifically designed to handle a wide variety of small and medium sized jobs economically and efficiently.

Learn how a Pratt & Whitney-KELLER Machine can lower your die and mold costs and increase your profits. Send today for your copy of P&W Circular No. 490-2. Write on your Company letterhead to the Pratt & Whitney Branch Office nearest you or direct to West Hartford.

PRATT & WHITNEY PRODUCTS FOR THE MOLD AND DIE INDUSTRIES

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- Jig Borers
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- Keller (Tracer-controlled) Machines
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- Automatic Duplicating Machines for Forging Dies
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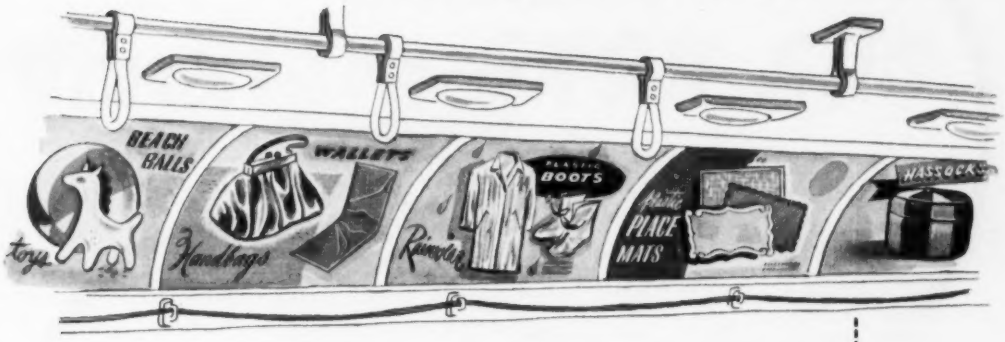
First Choice for *Accuracy*

MACHINE TOOLS • CUTTING TOOLS • GAGES

Are you missing the BUS when you seal plastics?



WELD *vinyl faster, cheaper, better with*

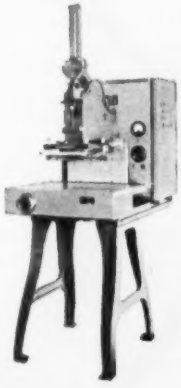
Thermatron
HIGH FREQUENCY SEALING AND HEATING EQUIPMENT

THERMATRON *welds*, doesn't *stitch* plastics. Produces permanent seams stronger than the material itself with never a weakening perforation! Permits development or design of many *new* products impossible any other way, and adds to your profits.

Standard THERMATRON models from ½ KW to 20 KW weld vinyl from .002" up to .080", serving most requirements — or we can build to your special needs.

Also available is the THERMATRON *Grommeter* for automatic grommeting or reinforcing operations . . . The THERMATRON *Welting Machine* for fast production of plastic binding and welting . . . and the THERMATRON *Automatic Quilter* for quilting of vinyl plastics.

Climb aboard the THERMATRON bus now! We'll gladly discuss your plastic sealing problems without obligation . . . And would you like a copy of our current bulletin? Ask for No. 69.



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RADIO RECEPTOR COMPANY, INC.

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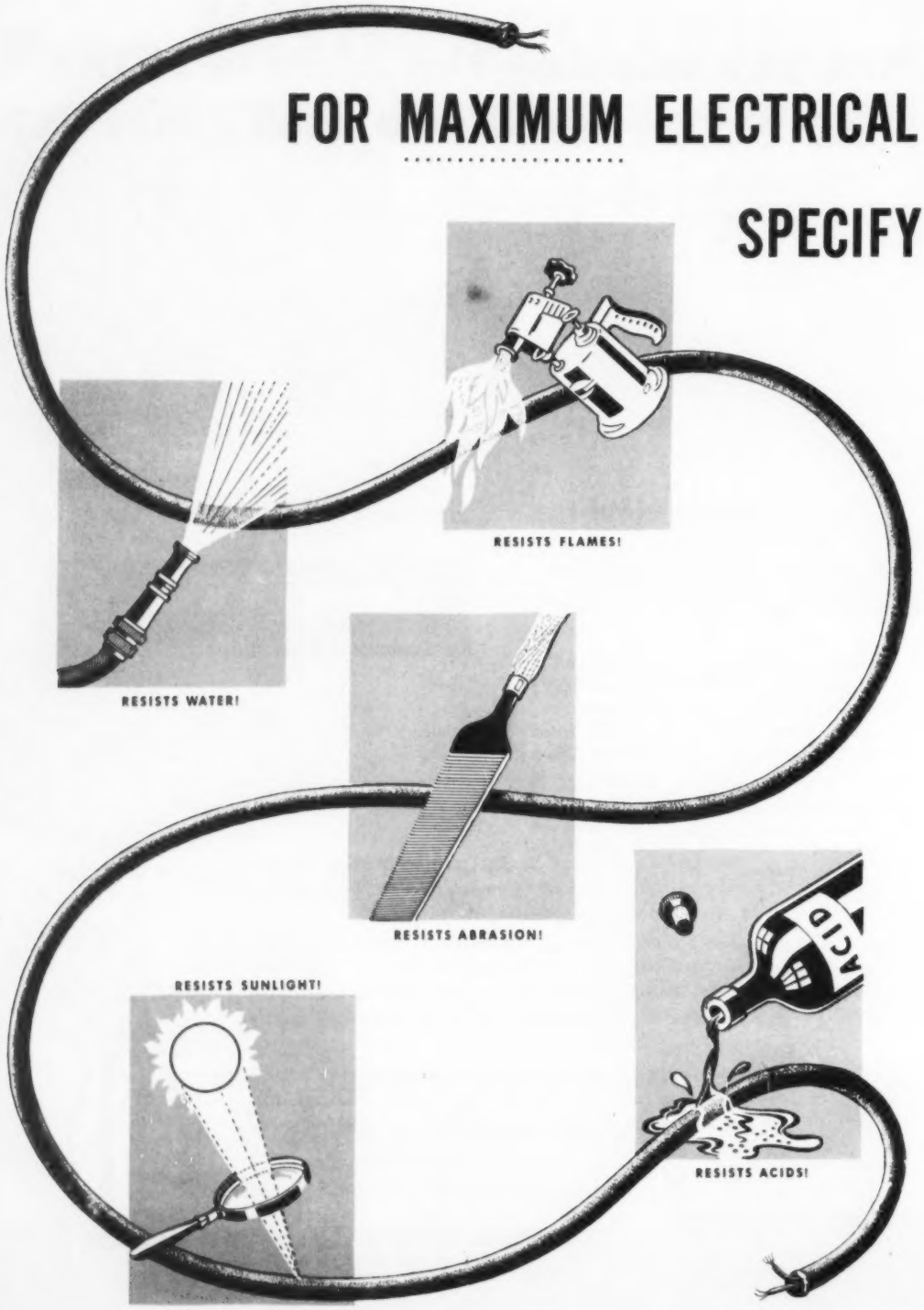


PROPERTIES AT MINIMUM COST...

Firestone EXON 500

Many of America's leading electrical manufacturers have found that Firestone EXON 500 is an ideal vinyl resin from which to produce thermoplastic insulation for wiring. This resin has many characteristics that make it "a natural" for applications of this type.

ANACONDA Wire and Cable Company, for example, uses Firestone EXON 500 in the formulation of Densheath, their internationally-accepted thermoplastic insulation.

EXON 500 is a high molecular weight polyvinyl chloride resin that has excellent electrical properties, color, heat and light stability, physical toughness and chemical inertness. Therefore, thermoplastic insulation made from EXON 500 is resistant to flame, oxygen, sunlight, moisture, acids, abrasion, most oils and grease.

Underwriters' Laboratories have approved compounds made from EXON 500 for PVC interchangeability and, in addition, compounds containing EXON 500 have been approved for specific applications. EXON 500 compounds are easily and inexpensively processed and can be extruded directly around wire as insulation. Code colors can be blended right into the formulation.

For assistance *in the application of EXON 500, or any other EXON resin, write or call:*

CHEMICAL SALES DIVISION, Dept. 7B

FIRESTONE PLASTICS CO., POTTSTOWN, PA.

PROPERTIES OF EXON 500

TABLE I

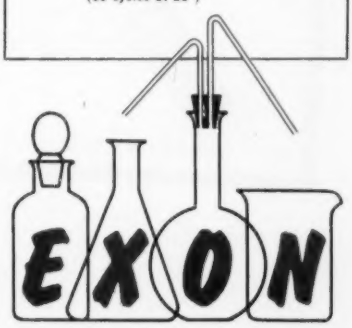
Resin Physical Properties

FORM	WHITE POWDER
Specific Gravity	1.40
Average Bulking Density, gm/c.c.	0.50
Average Relative Viscosity	2.55

TABLE II

Electrical Properties of a Typical Wire Compound

Insulation Resistance (15.6°C) (Megohms/1000 ft.)	4500
Dielectric Constant (23°C) (SIC—one day)	7
Dielectric Strength, KV. (in oil at 23°C)	36
Power Factor (60 cycles at 23°)	0.100



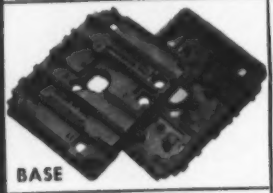
NEW IDEA IN SWITCH DESIGN

Molded by Mallory Plastics

When it comes to turning your new ideas into finished products, Mallory Plastics is well equipped to assist you in product design . . . to select the right material . . . to engineer and build tailor-made molds.

This new electric push button switch is a typical example. Each of the components presented a different problem in die design, material selection and production. In spite of these difficulties, Mallory Plastics produced it to the exacting specifications in the table below . . . and produced it economically and in quantity.

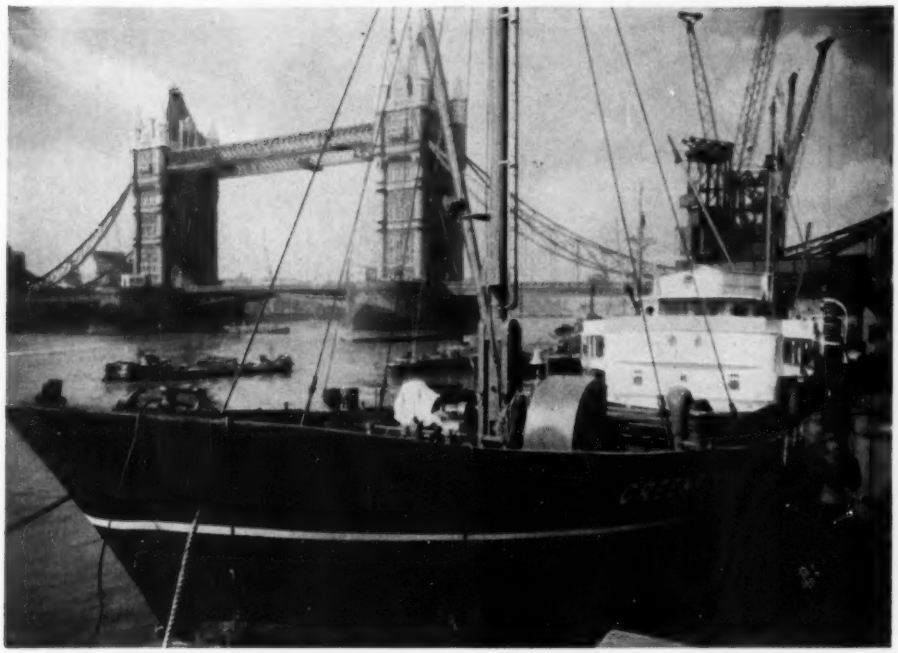
For your new idea in plastics, write or call us today for full details of our *complete* service.

PART NAME	PROCESS AND MATERIAL	SPECIAL REQUIREMENTS	COMMENTS
 BASE	Top-ram transfer molding • Phenolic resin	Dimensional stability at high temperatures. All dimensions to ±.002″	Over 350 dimensions in each cavity held to ±.002″ Die required 2000 separate machined parts for a 16 cavity mold.
HOUSING	Top-ram transfer molding • Phenolic resin	Dimensional stability at high temperatures. All dimensions held to ±.002″	Die designed to compensate for unequal shrinkage of sections of varying thickness. No warping — trouble-free assembly.
HEAT SELECTOR BUTTON	Injection molding • Acrylic	Buttons color coded and translucent. Must have good optical characteristics. Close fit on collar.	Result was button with good light conduction—no flow lines, refraction or surface flaws.

P. R. MALLORY PLASTICS, INC.
3670 MILWAUKEE AVE. • CHICAGO 41, ILLINOIS

A subsidiary of P.R. MALLORY & CO. Inc. MALLORY

World Wide Plastics



Tower Bridge, London

From the Port of London, and the other great sea ports of Britain, I.C.I. Plastics Division despatches to every quarter of the globe the widest range of plastics in the world produced by a single manufacturer.

This great export potential is supported by a world wide network of subsidiary and associated companies and independent agents through whom technical service facilities are freely available to all customers.

World Wide Service

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Plastics Division, Black Fan Road, Welwyn Garden City, Herts, England

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U.S.A enquiries to :—

Arnold, Hoffman & Co. Inc., *521 Fifth Avenue, New York 17, N.Y.*

P519

RUGGED, LOW COST AIR CYLINDER WITH BUILT-IN VALVE SETS NEW STANDARDS FOR FAST, PRECISION OPERATIONS

Built-in electrical operating controls, built-in 4-way valve, built-in dual piston rod speed regulators, all with a single air connection, simplify installation of economical pneumatic circuits.

Any repetitive push, pull or lift movement now done manually can be performed infinitely faster, safer, and at lower cost with this unique, electrically-controlled Bellows Air Motor. The range of work it can do is limited only by the imagination of the tool designer or production engineer.

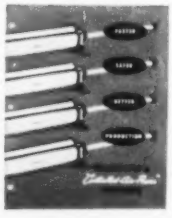
Unlike conventional air cylinders which require separate remote valves and cumbersome piping, The Bellows Air Motor is a complete power unit. It is compact, fits into crowded quarters, on moving machine elements. It is fast, responds to a starting impulse instantly. It is safe. Its low voltage operation simplifies wiring. It is sturdy, records of 10,000,000, 15,000,000, even 30,000,000 cycles without maintenance or repairs are commonplace.

The Bellows Air Motor is made in a wide range of mounting styles; in five bore sizes to meet varying power requirements; and in standard stroke lengths up to 48″. For mechanical or manual operation the Air Motor can be equipped with a built-in manual valve, or for operation in explosive-hazardous areas with the built-in explosion-proof electrically controlled valve.

The Bellows Air Motor gives you an entirely new conception of the productive possibilities of air power. In the thousands of manufacturing plants where it is in use, it is establishing daily new records for cost reduction and improved productive efficiency. In metal working, in plastics, in woodworking, in any industry you can name, these versatile power units are sparking the imagination of cost conscious production men looking for ways to do old and new jobs better.

WRITE FOR THIS FREE 32-PAGE BOOKLET

HERE IN THESE QUICK-READING PAGES IS THE STORY OF "CONTROLLED-AIR-POWER" — WHAT IT IS DOING FOR OTHERS — WHAT IT CAN DO FOR YOU. THERE IS NO COST, NO OBLIGATION. ADDRESS: DEPT. MP-1252, THE BELLOWS CO., BELLOWS BLDG., AKRON 9, OHIO. ASK FOR BULLETIN CL-30.



The Bellows Co.
AKRON 9, OHIO

1464

BELLOWS "CONTROLLED-AIR-POWER" DEVICES FOR FASTER, SAFER, BETTER PRODUCTION

Friends are our real blessings . . .
And from them come the
true joys of this life.

Our fondest hope, therefore,
is that we may continue
to merit your goodwill
in years to come.

To You and Yours . . .

MERRY CHRISTMAS . . .

from

Amos
MOLDED PLASTICS . . .
EDINBURG, INDIANA

Expanded production facilities will triple Plasticizer production.

By mid-1953, Emery's revolutionary ozone oxidation process will greatly increase the availability of the Plastolein Plasticizers as well as exclusive Azelaic and Pelargonic Acids.

If you are not already using a Plastolein Plasticizer, start an evaluation today. Their lower costs will result in the increased use of certain of these products as basic vinyl plasticizers. Others will be very attractive as specialty plasticizers. All are noted for their low temperature properties, stability to heat and light, low water and oil extraction, low volatility, and excellent "hand" and drape.

Start an evaluation today. Write for samples . . . mail coupon for descriptive booklet.

PLASTOLEIN 9050 DHZ—(di-2-ethylbutyl azelate)—a highly-efficient specialty plasticizer for high clarity vinyl films, coated fabrics, extrusion compounds and other elastomers where low-temperature flexibility is essential. Excellent for non-thickening dispersions.

PLASTOLEIN 9058 DOZ—(di-2-ethylhexyl azelate)—a good all around basic plasticizer that also imparts excellent low temperature properties. Its outstanding combination of properties leads to its use in any vinyl product. Also advantageous for nitrile and GR-S rubbers.

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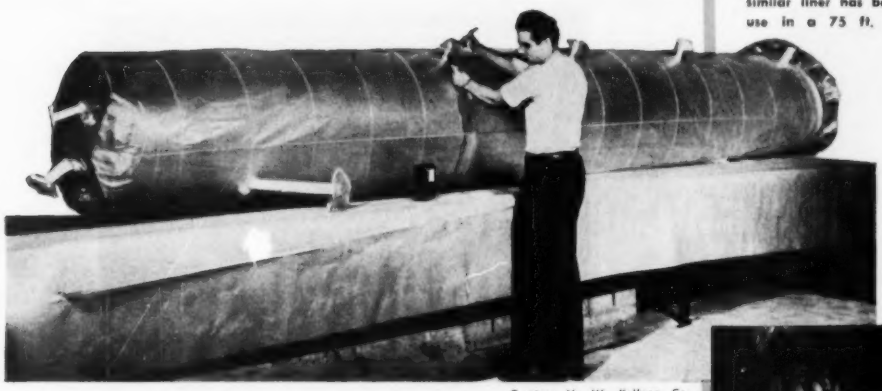
MODERN PLASTICS

VOLUME 30 DECEMBER 1952 NUMBER 4

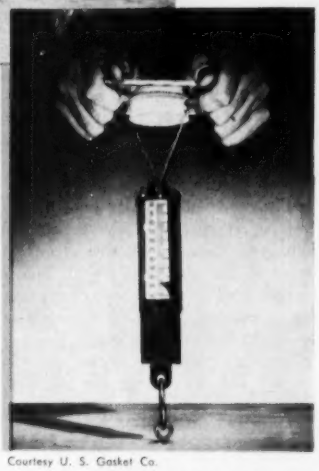
FLUOROCARBONS

Face Fame and Fortune



Courtesy M. W. Kellogg Co.

Liner for fractionating tower handling hydrofluoric acid was fabricated from two layers of 0.005 in. thick Kel-F film extruded by Electronic Wave Products, Inc. The film was electronically fused to form a closed cylinder 18 ft. long by 3 ft. in diameter. A similar liner has been fabricated for use in a 75 ft. distillation tower



Courtesy U. S. Gasket Co.

Bond strength over 40 lb. is shown in test of joint between disk of cementable Teflon and surface of glass plate

In four sections, the first part of this article covers the general aspects of fluorocarbon polymers. A discussion of Teflon starts on page 83 and of Kel-F on page 170. Specific applications of these materials are described in the last section, starting on page 175

FLUOROCARBON polymers could figuratively qualify as the combined Tiffany, Chippendale, and Champagne of the plastics industry. It naturally follows that like any quality product they require master technicians to produce them and master craftsmen to form them into usable products. Not only skill but extreme attention to detail must be observed in handling these materials, which cost from $6 to $12 a pound in quantity lots. In addition, they often require use of unconventional equipment not heretofore common to the plastics industry.

Nevertheless, processing of fluorocarbon plastics is an attractive business for those who learn how to handle them efficiently. An example could be a current military product for which a molder might receive and process about 5000 lb. of fluorocarbon a month. The material costs $60,000. If he were processing polystyrene valued at $60,000, he would probably have to handle about 175,000 lb. of material and his profit would probably be no greater, perhaps not as great, as from the 5000 lb. fluorocarbon job. Admittedly, this example is developed around a special case, but it helps to illustrate the point that profits can be and are being made from handling

low volume, high quality plastics.

The fluorocarbons are no longer laboratory specimens—they form an active, prosperous section of the plastics industry and are destined to play increasingly important roles in the broadening out of industry. Not only will their use improve present equipment used in American factories but they will make possible the performance of tasks never before possible. There is scarcely a manufacturing plant in the United States that could not use some type of product that is molded or fabricated from fluorocarbon parts even today . . . and progress has scarcely begun.

Over 100 Processors

There is no good estimate of fluorocarbon plastics volume available for publication. The best known is that made by the Harvard Graduate School of Administration* which states that over $7 million of fluorocarbons had been sold by 25 processors up to 1952, but there are over 100 processors in business today. By far the biggest portion of that $7 million was absorbed by the electrical industry as wire insulation, etc., but other processors are rapidly cutting down that percentage. It should be acknowledged that over 90% of the business today is related to military applications. However, the experience gained in both fabricating and end use will be eventually transferred to civilian applications.

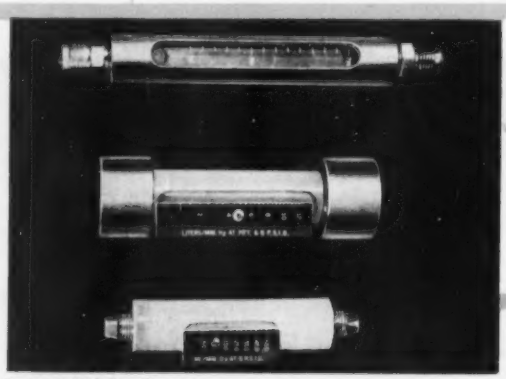
Fluorocarbon plastics are the result of reseach on how to control fluorine. Fluorine is the strongest man in the chemical world, but if surrounded with enough electrons, he is helpless to act. If released in a room, fluorine gas might destroy everything therein, including the room; but by combining fluorine with other materials, chemists have learned how to control it.

The first commercial fluorocarbon was the refrigerant, Freon 12, which is a combination of carbon tetrachloride and hydrofluoric acid. The latter is produced from fluorspar and sulfuric acid. Some 200 Freon compounds have been developed, only a few are in actual production, and from one of these are derived fluorocarbon plastics. Du Pont now has six Freon formulations on the market and General Chemicals has recently announced a line of Genetron compounds which are similar type materials.

* "An Appraisal of Fluorocarbons," a comprehensive study from which many excerpts were used in preparation of this article.

Courtesy Du Pont Co.

Rejects dropped, sharper designs resulted when cookie rolls like this one at Weston Biscuit Co. were coated with Teflon



Courtesy M. W. Kellogg Co.

Hydrofluoric acid measuring gages machined from Kel-F rod and tubing

New Family of Products

Freon compounds represent about 90% of the commercial organic fluorine chemicals in use at the present time. Because of their importance to plastics, it is important to note the great variety of uses for which fluorocarbons are destined. This versatility assures a new family of products in the future; a guarantee that increasing quantities of fluorine chemicals will be sought for; continuous research which should eventually result in lower costs and even more uses.

Here are the presently known uses—nearly all of them developed from a Freon type raw material: refrigerants; plastics; fire extinguishers; liquid coatings; heat transfer agents; lubricants and hydraulic fluids; rubbers; dyestuffs; coolants and dielectric fluids; solvents; propellants for insecticides, perfumes, lather, etc.; gas blankets for fire protection; and fibers.

The propellant or aerosol field is likely to become the most active next to refrigerants almost immediately. Insecticides, deodorants, waxes, and similar products already are being produced in huge quantities and the market is wide open for expansion in both those products and others. Among the newcomers is foamed lather or shaving cream, which alone has jumped from 2.6 million cans in 1951 to an estimated 15 million in 1952.

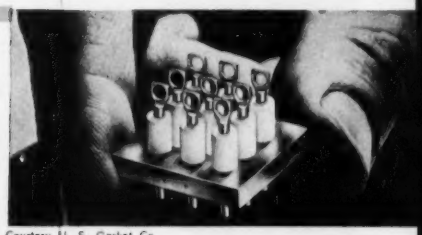
As Plastics

The present publicized fluorocarbon plastics are Teflon, Kel-F, Fluorothene, and Veloform. Fluon, a material similar to Teflon, is produced by ICI in Great Britain. Of these, only Du Pont's Teflon is a pure fluorocarbon; that is, it contains only carbon and fluorine. In

Courtesy M. W. Kellogg Co.

Dispersion of Kel-F (small particles of the material suspended in water) is applied to a large valve by spraying

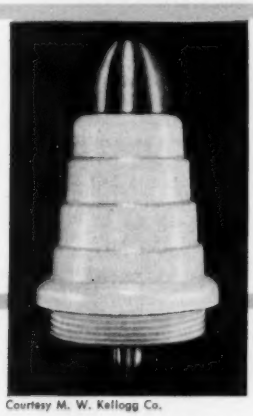
Transformer terminal has one molded Teflon part. Replaced terminal had 63 parts, had to be hand assembled



Courtesy U. S. Gasket Co.

Courtesy U. S. Gasket Co.

Large disks of Kel-F, produced by compression molding for Atomic Energy Commission, are 45 in. in diameter, 1/16 in. thick, and weigh approximately 20 lb.



Courtesy M. W. Kellogg Co.

Electrical insulator molded of Kel-F. This 1½-lb. piece is 4 in. long and has a bottom diameter of 2¾ inches. Threads can be provided by molding-in or machining

Kel-F and Fluorothene (chlorotrifluoroethylene polymers) a chlorine atom is substituted for one of the fluorine atoms in the molecule. In Veloform, vinylidene chloride is the basis of the molecule.

Teflon has most symmetrical molecules, which is one reason why its electrical properties rate highly, but it has the great additional factor of heat resistance that will withstand 500° F. in service and will lose no properties at −100° F. However, its very purity and extremely high resistance to all manner of chemical attack and mechanical abuse are sometimes a handicap in certain types of fabrication. So the chemists have devised ways to substitute organic and other materials in place of one or more of the fluorine atoms in a molecule and produce what might be called modified fluorocarbons.

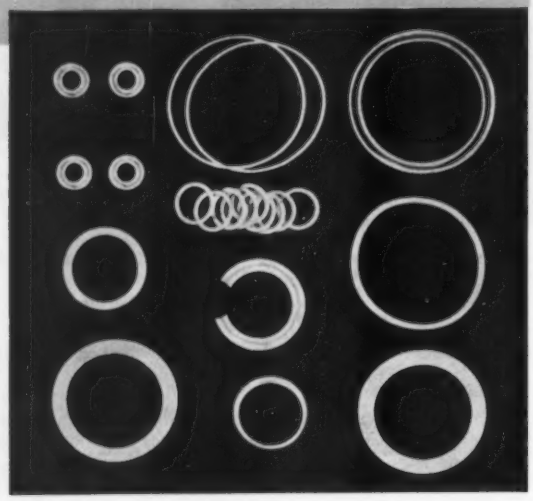
Other fluorocarbons, such as those named above, have magnificent properties, but their heat resistance, for example, is not as high as Teflon. Kel-F's highest heat resistance for service is around 390° F. On the other hand, Kel-F is generally recognized as being easier to mold or fabricate—it has very little cold flow and has properties that amply fit it to perform highest grade work. It has been said that Teflon and Kel-F will each find its own fields of usefulness, but there is almost certain to be an overlapping field where competitive features will seek solution in price, properties, performance, and the method of fabricating a given end product.

The two fluorocarbons named above are mentioned first because they have been commercially available for several years and already are well known. Each will be discussed in detail after a brief mention of other fluorocarbons which have not been available until recently, or are still in the development stage.

Bakelite's Fluorothene is available in only very limited quantity at present, but a new plant is scheduled to be completed in 1953 with an estimated capacity of somewhere around 50,000 lb. a month. Bakelite has been producing and selling modest quantities for two years and has piled up a great col-

Photos courtesy W. S. Shamban & Co.

Groups of typical molded and fabricated fluoroplastic parts, showing diverse sizes and shapes. Above: Upper left—machined Teflon radar insulator; upper right—molded Kel-F chemical valve diaphragm; center left—transformer insulator molded of Teflon; center right—machined Teflon coaxial insulators; lower left—valve stem packing machined of Teflon and used in commercial equipment; lower right—stamped Teflon aircraft valve seat. Below: Top row—left to right—molded Teflon chevron rings, molded Teflon "O" rings, and machined Teflon chevron ring stem seal. Center row—left to right—molded ring, special molded "V" ring, and Teflon "O" rings. Bottom row—left to right—flat Teflon disk for valve seat, special machined packing rings, and Teflon "O" ring



lection of technical information. Part of this information is obtainable in a report to the Navy entitled "Characterization of Monochlorotrifluoroethylene Polymers, Final Report U. S. Navy Contract No. bsr-42427, Index No. NE110526" which can be obtained from the Library of Congress in Washington, D.C. on microfilm for $3.50, or in photostat form for $10. Another Bakelite report on Fluorothene wire insulation appears on p. 126 in the technical section of this issue of MODERN PLASTICS. A great part of the company's development work has been on extrusion of Fluorothene over wire and a technique for producing transparent film.

Firestone's Exon 400 XR-61, formerly known as Veloform, which is reputedly a copolymer of vinylidene fluoride and chlorotrifluoroethylene, received most of its early publicity as a coating material but is listed as a material that can be injection molded at 435° F. and a pressure of 10,000 p.s.i. Compression moldings can be made at lower pressure. It can be heated in air to 350° F. for 100 to 200 hr. without apparent loss in physical properties. It is particularly recommended as a coating for metal containers. It can be applied to iron, wood, concrete, or other reaction vessels or tanks to permit their use as a replacement for glass or stainless steel.

New Family Eventually

Since fluorine or fluorine compounds can be synthesized or used with thousands of other chemicals, it is reasonable to believe that a whole new family of fluorinated plastics will eventually appear on the scene. One hardly dares to even dream of the possibilities there are for the development of inert materials from combinations that might even make building structural materials more applicable than anything now known. The synthesis and polymerization of fluorostyrenes with a heat resistance of over 400° F. has been reported. Work toward introducing fluorine into other polymers, such as silicones, has been started. Only a brash man would predict what the future has in store.

Along this line the work of Minnesota Mining and Manufacturing Co. should be noted, although details do not properly belong in this article. That firm is working on an electrolytic method for producing fluorocarbons which could possibly cut production costs by a large percentage and is particularly aimed at fluorination of a large number of materials. A recent announcement stated that the company had produced a fluorine containing synthetic rubber that has better low temperature flexibility, heat stability, and ozone resistance than any other known rubber; these are the three greatest weaknesses in rubber today. Although no fluorochemical plastics have been released to the trade, the company has been working on fluorinated vinyl types and brand new varieties of possible plastics, such as perfluoro-olefins, which can be polymerized with other plastics, rubbery polymers of the perfluoro alkyl acrylate type, and perfluoro aldehydes.

Teflon

Teflon (polytetrafluoroethylene), first of the fluorocarbon plastics, like Mr. Goodyear's vulcanized rubber, was an accidental discovery. In 1938, a Du Pont researcher opened a Freon gas cylinder which was thought to be empty, only to discover a white powder inside—the gas had polymerized into what was later called Teflon. Several years were required to reproduce the result of the accident, but small amounts of the material were made available to the Government during World War II and limited commercial quantities have been available since then. A new plant has been recently completed so that present demand can be supplied.

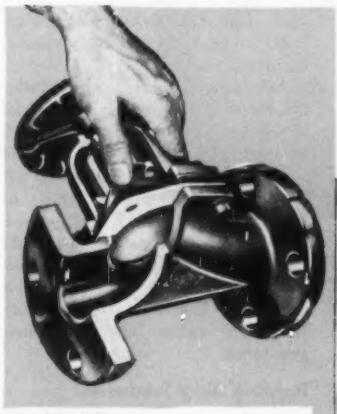
High cost, of course, has delayed big volume use since applications must be found where the material will do a better job than any other. Teflon sells today for $5.50 a lb. in resin form and $8 a lb. on a solids basis in dispersions (60% solid).

Teflon is called a thermoplastic by Du Pont, but many people contend that it is not. The truth seems to be that it has an extremely high viscosity at the melting point and becomes a gel which can be handled as a semi-solid. It certainly is not a thermosetting material, because when heat is applied a second time, the material forms a gel again. It seems best then to state that Teflon is an individualistic or new member of the materials family and is quite different from any other substance now known.

Teflon can be neither injection nor compression molded in the usual sense, but it is molded by a process comparable to that used in powder metallurgy or ceramics. It does not flow under ordinary molding temperature, but at 620° F. it becomes an amorphous gel and fuses. The procedure then is to compress preforms under a pressure of at least 2000 p.s.i. and bake in an oven or fluid bath at 690° F. In thick sections, ¾ in. or more, the preform is generally left in the mold during baking and pressure is applied while cooling. On removal from the oven, pieces are transferred to a coining die where they are repressed to size and cooled under pressure. Shrinkage after coining is of the order of 2½% or 0.025 in. per inch. In small, simple shapes, the coining may sometimes be omitted. U. S. Gasket Co. technicians say that shrinking can be controlled by the length of time the piece is held in the die while cooling. However, it should be noted that metal inserts are generally difficult to handle in a molding because of the 4 to 1 compression ratio, so the fitting must be mechanical or by adhesion, thus requiring a post

Comparative Chart Showing Some Properties Of Various Plastics

Properties	*Kel-F*	*Teflon*	*Polyethylene*	*Nylon*	*Silicone Glass Filled*
Compression molding temperature, °F.	445-500	700°F	275-300	—	340-430
Injection molding temperature, °F.	440-550	Not possible	300-500	510-530	—
Injection molding pressure, p.s.i.	20,000-60,000	—	10,000-15,000	10,000-25,000	—
Compression ratio	2.0	—	2.1-3.6	2.1	10
Mold shrinkage, in. per in.	0.005-0.010	0.025	0.02-0.05	0.015	—
Specific gravity	2.1	2.1-2.3	0.92	1.14	1.11-1.23
Specific volume, cu. in. per. lb.	13.2	13.2-12.1	30.1	24.2	16.3
Tensile strength, p.s.i.	5700	1800	1300	10,900	3200
Compressive strength, p.s.i.	32,000-80,000	1700	—	13,000	11,200
Flexural strength, p.s.i.	8250	1600	—	14,600	9800
Impact strength, ft.-lb. per in. of notch (½ by ½ in. notched bar, Izod test)	3.6	2.5-4.5	3	1.5	4.0-4.5
Thermal expansion 10^{-5} per °C.	4.5-7.0	10	16-18	10	—
Resistance to heat, °F. (continuous)	390	500	212	300	480
Heat distortion temp., °F.	—	270 (66 p.s.i.)	107 (66 p.s.i.)	400 (66 p.s.i.)	570
Water absorption, 24 hr., ⅛ in. thickness, %	0.00	0.00	0.01	1.5	0.07

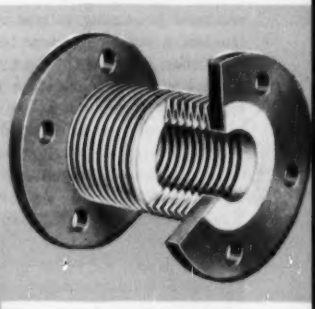


Courtesy Grinnell Co.

Plasticized Kel-F diaphragms are used in chemical pipelines where other materials fail because of corrosion

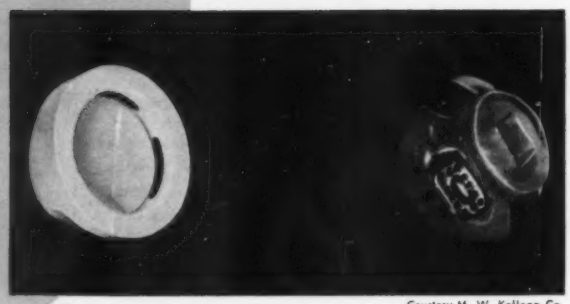
Dramatic proof of the release properties of Teflon: drippings of adhesive on Teflon coated glue pitcher readily strip off; uncoated pitcher defies cleaning because glue adheres stubbornly

Courtesy Du Pont Co.



Courtesy U.-S. Gasket Co.

Bellows of expansion joint (shown sectioned to illustrate construction) is fabricated of Teflon. Such joints compensate for expansion and contraction in pipes; overcome effects of slight misalignments of equipment; and dampen vibration



Courtesy M. W. Kellogg Co.

Artificial eye implants that become permanent parts of the body and that give natural movement to acrylic artificial eyes, are machined or molded of Kel-F and attached to muscles with sutures or staples

Courtesy U. S. Gasket Co.

Perforated Teflon sheet used for filtering and sifting corrosive chemicals

molding assembly operation. This same company also reports that the entire molding process can be made continuous and that pieces have been turned out at a rate of almost 2 per minute.

Machined from Rods or Tubes

Up to this time, however, most Teflon parts have been machined from molded or extruded rod or tubing. In screw extrusion, the screw is used merely to compact the powder while it is still cold, and to force it through a die having a long heated land where sintering takes place. A 2½-in. extruder will produce between 10 and 12 lb. of extruded stock per hour. Processors are now beginning to use ram extrusion, a relatively new technique for Teflon, because of lower equipment costs and production rates as high as 20 lb. per hour.

Wire coating is performed by dip coating from a dispersion; extrusion of a lubricated powder; a special type of calendering; or screw extrusion when the coating is over 50 mils thick.

The dispersions mentioned above are small Teflon particles suspended in water. They are adapted to impregnations, to mixing with fillers, to coating of surfaces by spraying and dipping.

Perhaps the most promising of the new developments based on Teflon dispersions has been their use in the preparation of filled compounds. Modification with fillers improves mechanical properties and reduces cost, as well as broadens the base for applications.

The general effect of fillers is to increase stiffness, hardness, and compressive strength with a reduction in deformation under load and elongation and a comparable decrease in electrical properties. Thus, for example, a graphite compound has a high thermal conductivity; an asbestos compound has high stiffness. Fibrous glass, coke flour (never before used in plastics), powdered metals, mica, carbon, ceramic, and all sorts of things have possibilities for this development, which is now also being evaluated for Teflon extrusion compounds.

Dispersions as Binders

It can hardly be emphasized too strongly that this use of Teflon dispersions as a binder for fillers means the development of a whole new series of construction materials. Among possibilities in the chemical field are piping, valve parts, pump parts, bearings, wear rings for mechanical seals, and heat exchanger tubes. In the electrical field, there may be resistors, brushes, tube sockets, and insulators . . . plus about 1200 other assorted products!

The thermal stability of Teflon is superior to that of any other organic polymer; it is suitable for continuous service at 500° F. Even after a steady heat of 570° F. is applied for a month, tensile strength drops only 10 to 20 percent. Evidence of stability and maintenance of properties is shown by an almost infinitesimal weight loss after 600 hr. baking at 550° F. —there is no weight loss ever at 500° F. At low temperature, the material shows a useful degree of toughness in liquid air at −320° F.

Teflon's chemical resistance is probably its outstanding property. Only fluorine, chlorine trifluoride, and molten alkali metals will react with it, and only at elevated temperature. It is relatively flexible and has high impact strength. Its elasticity and plastic memory, together with chemical resistance, make it ideal for gasketing. When the deforming load is removed, there is some recovery, but never complete until heating reaches the transition temperature of 620° F. The Teflon part is pressed into the metal assembly at a low temperature and in such a manner that the deformation produced will make the joint tighter as the temperature increases and Teflon tends to recover its original shape.

As an electrical insulator, Teflon is used in power equipment and for high frequency work. Dielectric strength ranges from 750 to 2000 volts per mil of thickness. It will withstand arcing for 700 min.; on breakdown, no carbonized path is left. It is claimed to be one of the best insulating materials available that possesses the combination of extremely low loss over a broad frequency range, and good heat resistance.

Handling Sticky Substances

Because of its non-adhesive properties, Teflon has solved many problems in handling sticky substances and is consequently valu-

able in the food, baking, and rubber industries and in heat-sealing equipment.

There have been complaints about excessive cold flow, but U. S. Gasket Co. maintains that the cold flow of Teflon is not excessive and occurs only during the first few hours of compression. At any given temperature and pressure, equilibrium is quickly reached and there is no further change unless load or temperature is changed. U. S. Gasket technicians assert that cold flow can be controlled by proper molding technique.

The first commercial uses of Teflon were in gaskets for highly corrosive chemical service where they have proved essentially permanent. A typical case is the gasket between sections of an evaporator for mixed nitric and sulfuric acids where the temperature is 410° F. The Teflon lasted 18 months in comparison to one month for asbestos. Sometimes the Teflon is used as an envelope over asbestos or other soft filler.

Furthermore, the anti-adhesive property of Teflon prevents sticking and damage to the gasket where joints must be opened frequently. For this purpose, the material is suitable over a temperature range from −150° F. to 550° F.

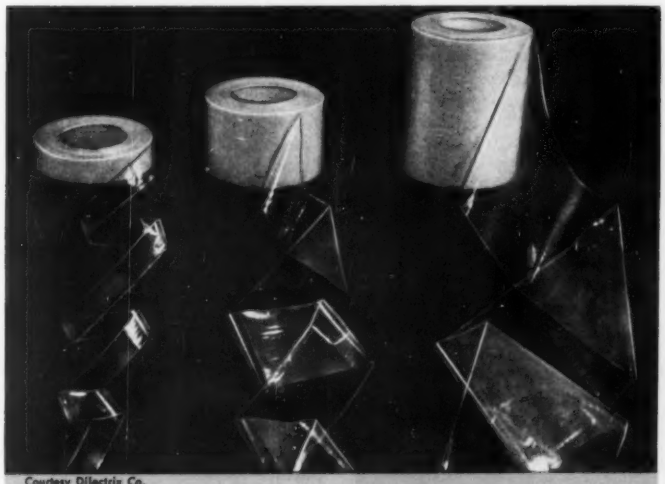
Snap-on gaskets for conical-end glass pipe, specially molded to allow for deformation, and gaskets for packing valve stems that will provide the necessary seal at low pressure, have already become widely accepted in the chemical, food, pharmaceutical, and petroleum fields where corrosion and high heat resistance are problems. They are especially useful for glass pipe when there is not enough bolt pressure to make a good seal with otherwise acceptable materials.

In the milk industry, where glass fittings are so widely used, Teflon gaskets are not affected by steam sterilization.

Last 10 Times Longer

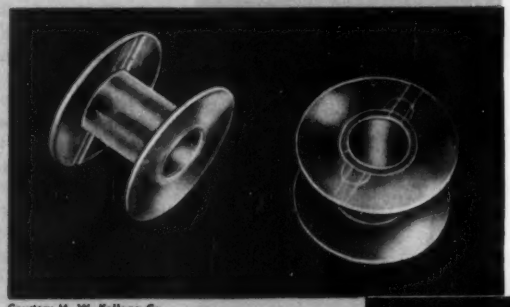
In this field of gasketing, Teflon is replacing asbestos, bronze, graphited bronze, cast iron, and specialty rubbers. Even at 10 times the cost of another material, Teflon is less costly because it will generally last more than 10 times longer.

Among the most striking of present Teflon applications is an expansion joint or bellows-like piece of piping which U. S. Gasket produces from a Teflon cylinder or tube. It can be made in most any length de-



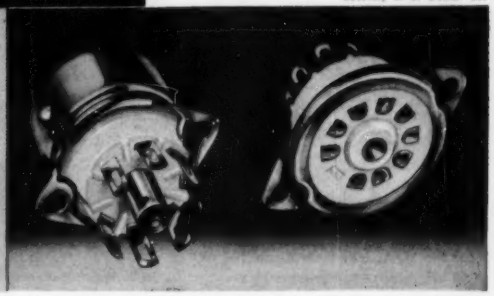
Courtesy Dielectrix Co.

Thin cast Teflon film (shown above are 400-ft spools of 0.0005-in. material) is particularly adaptable for insulating purposes in miniature electrical components



Courtesy M. W. Kellogg Co.

Coil forms injection molded of Kel-F have good electrical insulating properties and zero moisture absorption



Courtesy U. S. Gasket Co.

Electronic tube sockets of molded Teflon are serviceable at temperatures from -110° to 575° F. for long periods with negligible changes in critical factors. They are unaffected by humidity, corrosive atmosphere, or fungus attack

sired, with from 2 to 12 convolutions, and since tubing has been molded up to 20 in. in diameter, an expansion joint of near that size could presumably be machined if necessary. Expansion joints are used in connections when varying temperatures between two lines of pipe are encountered and to compensate for slight misalignments. Various kinds of pipe lines, especially glass or ceramics, require them. These Teflon joints also serve as dampeners of vibration, as between a pump and a pipe line.

The bellows-type joint has been recently supplemented with a two-convolution Teflon coupling, assembled with flanges of cast iron, aluminum, or other metals and embodying integral gaskets. These connections are used not only for pipes of like material, but also for Pyrex glass-lined steel, or Karbate, Haveg, and steel pipe. These couplings make use of adapters and slip joints unnecessary.

Valve seats and disks promise to become one of the leading outlets for Teflon. The pressing of a valve disk into its seat seems to be an operation peculiarly fitted to Teflon for the following reasons: The mechanical distortion of the material under pressure assures a good closure; if a small speck of foreign matter gets into the valve, it will become embedded in the Teflon without damage—in metal, the speck would damage the valve. In metal valves, the producer has an expensive operation in grinding the valve disk into the seat; when Teflon is used, there is no necessity for fine machining. If a Teflon valve part is damaged, it can be replaced from stock without need for making a lot of expensive adjustments as is necessary in metal valves.

The newest thing in Teflon construction is said to be piping, together with fixtures and T-joints, produced by Resistoflex Corp., Belleville, N.J. The new pipe, now in pilot plant production, is a combination of fibrous glass sheet and Teflon. It will be furnished in stock sizes ready for installation. Since it is impervious to chemical attack and since almost no fluids are transferred at temperatures higher than 550° F., this pipe will handle practically anything known in a chemical plant. It can replace ceramic and metal alloys and probably last as long as any equipment in a plant. Because of the safety factor, it also helps employee relations since no guards or shields would be necessary to protect the workers from possible spillage.

Courtesy U. S. Gasket Co.

Diaphragms were among the first fluorocarbon plastics applications. One type fabricated from Teflon is shown here. They are particularly useful in chemical plants because of corrosion resistance. Teflon diaphragms with metal edges can be hermetically sealed

Courtesy U. S. Gasket Co.

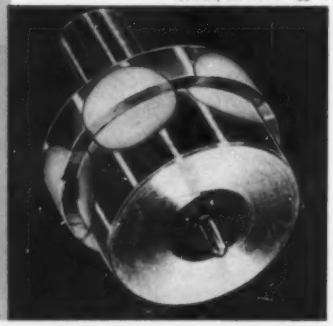
Flexible couplings made of Teflon are used for joining piping of similar or different materials. They eliminate need for slip joints; they also take the place of gaskets at the point of use

High-voltage, high-frequency insulator for aircraft radio power supply has plastic parts made of pure Teflon

Courtesy U. S. Gasket Co.

In rotary switch made for Thompson Products, Kel-F is injection molded into metal switch case around an intricate insert to give a satisfactory hermetic seal between the plastic and the metal

Courtesy M. W. Kellogg Co.



Tape and Film

Teflon tapes or films are notable for their stretch and plastic memory, which make them applicable to curved surfaces. When heated, they become tighter instead of looser as the temperature rises. Tensile strength of oriented Teflon tape may run as high as 15,000 p.s.i.

There are several methods of producing tape or film, but improvements and new techniques are being announced so frequently that only a specialist can keep up with them. Film can be made in thicknesses of 1 mil or less, but it is generally marketed in thicker sections. If below 2 mils, it is generally cast from a dispersion and then quenched—in quenching it becomes transparent. Cast film is made by laying down one layer over another of thicknesses each of which must not exceed 1½ mil. Skived film is produced in thicknesses of from 2 to 60 mils. If over 60 mils, it is classified as sheet and must be molded. A third method is by calendering from molding powder by a method

in which the preform is fused in an oven or in a heat transfer salt bath which is located under the calender rolls.

About 30% of all cast Teflon tape is used in condensers—the remainder is used for layer insulation and such things as windows of instruments and wrapping electronic parts.

Dilectrix Co., New York, N.Y., is an example of a company that is producing film from 0.00025 to 0.002 in. gage by the aqueous dispersion casting method. Its film has been successfully used for electrical insulation in motors, generators, and transformers, and for taping coils and wire leads.

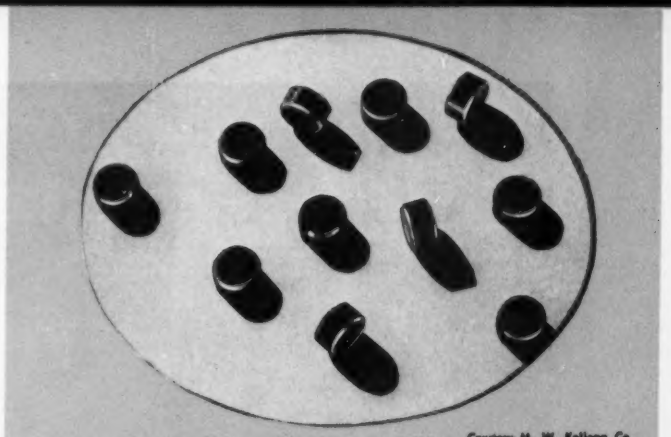
Minnesota Mining and Manufacturing Co., pioneer tape manufacturer, is producing tape by still another method—ram extrusion of Teflon paste. Two types are available—type A is a fused tape; type B is unfused. The latter is used in layers for wrapping coils and other equipment. After wrapping, all the layers are fused together.

These tapes are expected to find wide use for Class H insulation of all sorts. Small wires can be insulated with type B tape, and the insulation fused at temperatures as low as 650° F. in 15 to 20 min., or in 15 sec. at temperatures of 1000° F. This tape is being evaluated in the manufacture of printed circuits.

Impregnated Glass

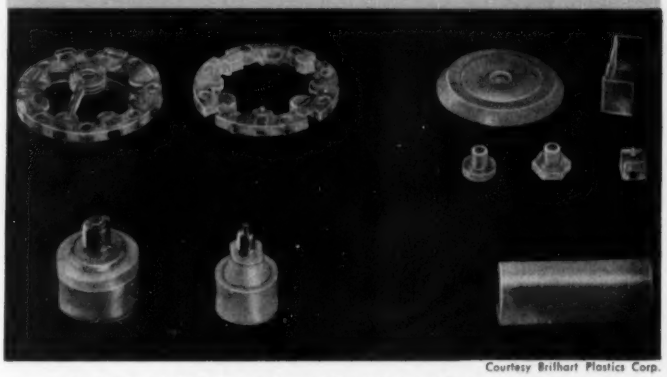
Among the more recent triumphs for Teflon is resin impregnated or coated glass fabric. It is heat resistant, anti-adhesive, inert to chemical attack, and is exceptionally strong. It is destined for many applications. Among the newest uses is the Du Pont Fabrics & Finishes Dept.'s conveyor belt for candies.

In the manufacture of caramel candy, such a belt has replaced a leather one, and also two girls who were employed, one at each end of the continuous belt mechanism, to prevent the candy from sticking—one of them sloshed edible oil on the belt, the other wiped off the surplus. The candy maker now gets a better looking product unsullied by oil or dusting flour. Even if the belt cost reached $1000, it could be a profitable investment. The same type belt can be used to replace pyroxylin coated belts in chocolate candy plants because it is not affected by cocoa butter, and the individual candies won't stick.



Courtesy M. W. Kellogg Co.

Compression molded valve seats made of fibrous-glass filled Kel-F are used in compressed-gas tanks. Parts have minimum deformation over a wide temperature range



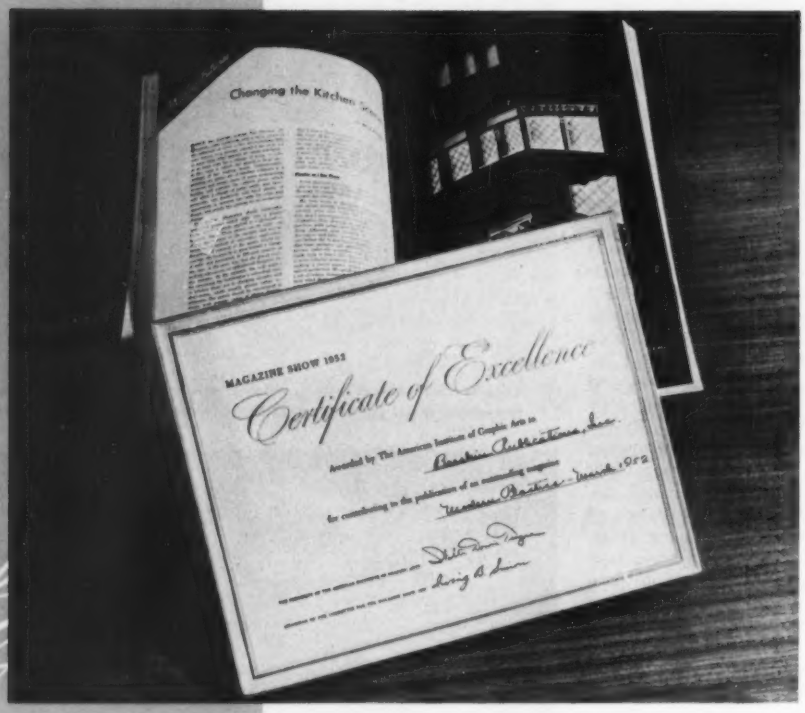
Courtesy Brifhart Plastics Corp.

Injection molded Kel-F parts. Upper left—socket parts for vacuum tubes are produced on a 2-min. cycle. Lower left—antenna mounting nuts for a walkie-talkie resist extremes of atmospheric conditions. Upper right—float and other parts for fuel measuring devices in airplanes are resistant to chemical attack. Lower left—a shield used with electronic equipment; the fluoroplastic was selected because of electrical properties

Production of pulverized solids from sticky liquids can also be stepped up by using the Du Pont belts. Formerly, where batch operation was employed, the viscous liquid was cooled and solidified in pans and then had to be broken up and granulated. Former type belting would not take the required heat nor the chemical action of the liquid; in addition, the stuff stuck to the belt. With the new Teflon belt, the operation can be made continuous. The hot material is poured on the belt in a thin layer, run through a cooling tunnel, and automatically ground and pulverized as it falls into a machine at the end of the belt. The operation saves money, increases output, and makes a better product.

Teflon coated glass fabric belts will not shrink or stretch because of the glass fabric base. Their use is expected to expand to many fields, especially where sticking and high temperatures are problems. But the largest use for Teflon coated glass fabric is in electrical insulation such as wrapping on aircraft ignition wire, radio hookup wire, lead-in wire, and control instrument wire. Of course, it is used in many other applications where electrical insulation is found. Teflon coated glass fabrics are used as slot liner, coil support, and layer

(*Continued on p. 170*)



"Plastics Futures" Issue Honored

AT THE recent third annual Magazine Show of the American Institute of Graphic Arts, MODERN PLASTICS Magazine was honored for its original and significant contributions to the art of graphic editorial presentation.

Specifically chosen for special honor was the March 1952 "Plastics Futures" issue. In the opinion of the jury of editors, artists, and production experts who were elected to review the accomplishments of the more than 500 publications submitted, this issue represented a dramatic achievement in three separate categories of artistry—illustration and photography, typography and lettering, and printing craftsmanship.

The publications selected for awards by the jury were chosen on the basis of a point rating system designed to indicate an over-all proficiency in contemporary magazine design and production.

A Certificate of Excellence commemorating the award was presented to MODERN PLASTICS and the winning issue was included in the collection shown at the special exhibit sponsored by the Institute of Graphic Arts.

More Plastics in a Telephone

by L. W. DROEL*

IN THE manufacture of telephone equipment, the search for the proper combination of beauty and practicality is a never-ending one—yet the proposed design and material changes necessary to gain just such a combination are usually slow, evolutionary processes performed over the years. The announcement, therefore, by Stromberg-Carlson Co., Rochester, N.Y., of a newly designed telephone instrument, incorporating a major change to plastic materials, is the culmination of many months of careful research and functional engineering.

To the company's many customers among the more than 6000 telephone companies operating throughout the country independently of the vast Bell Telephone System, the new 1400 series telephone instrument offers durability, attractiveness, and economy. Major material change is the switch from the zinc die cast housing used on previous models to a rugged, handsomely designed Tenite II cellulose acetate butyrate housing. Principal design changes, while not making radical departures from the generally accepted family lines of the company's previous model telephones, resulted in a unit with a low, modern appearance for presenting the dial at proper eye level. Also included in the innovations were the locating of dial letters and numbers outside the outer edge of the finger wheel for better visibility, and the engineering of the instrument so that it can be used as either a desk or wall model by simply changing a set of plungers.

The unit's internal components include a number of phenolic, cellulose acetate, and cellulose acetate butyrate parts, vinyl insulated conductors, and a nylon outer braid for the line cord and the handset cord.

Housing Design

Since all the components of the telephone are mounted directly on the base, the butyrate housing functions primarily as a cover. It is easily attached to the base by fitting

Photos courtesy Tennessee Eastman Co.

Choice of cellulose acetate butyrate for the housing of newly designed telephone represents major materials switch. A zinc die cast housing was previously used

Three integral parts of dialing unit (top row, left to right)—blank, adapter, finger wheel—and hookswitch dust cover (bottom, left) are butyrate. The protective card holder and dial dust cover are acetate

* Telephone Apparatus Engineering, Stromberg-Carlson Co., Rochester, N.Y.

PLASTICS IN NEW TELEPHONE

PARTS	MOLDED BY
Butyrate housing	General Electric Co., Taunton, Mass.
Butyrate number plate Butyrate dial adaptor Butyrate dial blank	Thermold Corp., Manlius, N. Y.
Butyrate hookswitch cover	Watertown Manufacturing Co., Watertown, Mass.
Phenolic capacitor case	Diemolding Corp., Canastota, N. Y.
Acetate card holder	Brilhart Plastics Corp., Mineola, N. Y.
Acetate dial dust cover Butyrate dial dust cover lid	Ontario Plastics, Rochester, N. Y.
Phenolic hand set	Stromberg-Carlson Co., Rochester, N. Y. Diemolding Corp., Canastota, N. Y.
Phenolic mouthpiece Phenolic ear cap Phenolic plungers	Stromberg-Carlson Co., Rochester, N. Y.

a slot in a molded-in clip over a formed-up lug on the base. A taper-headed screw in another molded-in insert at the rear of the housing drops into a specially designed slot on the edge of the base. Tightening this screw draws the housing down neatly on the base.

The housing is molded in a two-cavity mold with gating through the openings provided for the dial. To maintain a uniform wall thickness and prevent shrink marks at the two molded-in inserts, the rear insert is formed to follow the outlines of the housing and the flat front insert is molded with a small cavity between it and the front housing wall.

In order to keep the side walls of the dial opening perpendicular to the slanted face of the housing, the mold was parted through the horizontal diameter of the opening, thus forming one half of the opening in the cavity and the other in the force. No wedges or side-draws are required in the mold to form the lift bar which connects the telephone plunger slots. This possible undercut was eliminated by allowing the force to project through the housing proper to form the underside of the lift bar. A separately molded cover is then required to fill the opening. This small cover is held in place by means of a self-tapping screw driven into a molded hole in a boss at the top of the housing.

The interior of the housing is well ribbed to strengthen the unit and these ribs are designed to nest over the formed-up edge of the steel base. This construction results in maximum strength, ease of assembly, and permanence of shape.

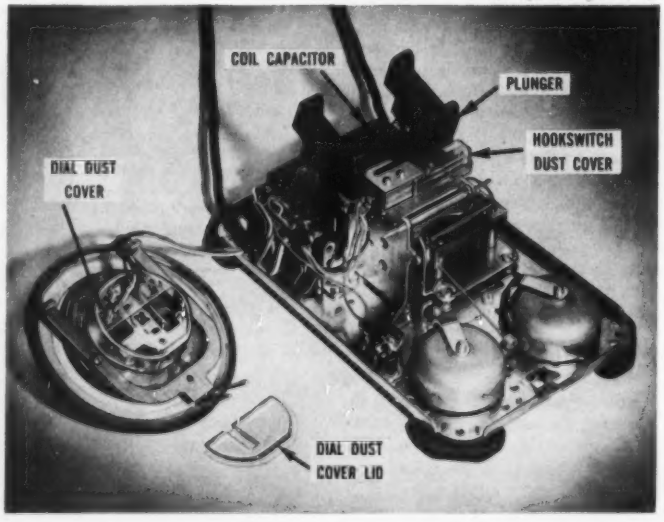
The dial in the new telephone retains the identical working mechanism of the older dial. The only change is the use of a plastic number plate in which the numbers and letters are located outside the finger wheel. The new number plates are molded of clear Tenite II cellulose acetate butyrate with the numbers and letters impressed in the underside of the part. These numbers and letters are filled with white pigment and the entire background is sprayed with black paint.

Any current model of the company's telephones may be converted to the new type dial by substituting the extended number plate. If, on the other hand, it is desired to use existing conventional dials on the 1400 series telephone, they can be snapped into place in the butyrate adaptor plate that is designed to receive any normal size American-made telephone dial.

The mechanism in the rear of the dial is enclosed by a clear cover molded of cellulose acetate through which the screw type terminals project. Part of this cover is cut away and a clear lid molded of cellulose acetate butyrate is snapped into place over the opening. When servicing is needed, the lid can easily be removed or, if necessary, the entire dial and the steel bracket to which it is mounted can be disengaged.

Acetate dial dust cover, with lid removed, and butyrate hookswitch dust cover are shown as secured in position. Coil capacitor behind hookswitch is enclosed in phenolic case

Courtesy Stromberg-Carlson Co.



A gasket of black polyvinyl tubing around the outer edge of the number plate insures a dust-tight seal when the housing is placed over the dial.

In those areas where manually operated central office equipment is in service, a two-part dial blank also molded of cellulose acetate butyrate is used. This unit mounts on the steel bracket in the same way as the normal dial.

The handset is molded of black Durez general purpose phenolic. The two electrical connections between the transmitter and receiver are made by means of long molded-in inserts made of brass stampings, the ends of which are formed up and threaded. Other round brass inserts for making the other electrical connections are pressed into the handset. The caps which hold the transmitter and receiver in the handset are also molded of general purpose Durez phenolic and are threaded onto the handset handle; the threads on the handle and caps are molded.

Internal Plastics

The working mechanism inside the telephone incorporates three newly engineered units making use of plastics—a direct-operating hookswitch; a single-coil high impedance ringer; and a universal coil-capacitor unit.

The compiete hookswitch mechanism is mounted on a bracket attached directly to the base. Contact springs are operated directly by a tab on the hookswitch lever and a single continuous phenolic pusher. When in service, the spring combination assembly is completely enclosed by a transparent cellulose acetate butyrate cover which slips easily into place. To secure this cover in position, small bumps are spaced around the lower edge of a recess in the cover. Part of the bracket upon which the hookswitch springs are mounted slips between the recess and the bumps. This results in a molding with undercuts, but because of the use of the small bumps for forming the lower lip of the slot, it can be easily snapped out of the mold.

The cradle-like plungers, which are attached to the hookswitch lever by means of small bearing pins, are molded of general purpose phenolic in an 8-cavity compression mold. The slot in the bottom of the plunger is at right angles to the bearing hole and is formed by a movable wedge from which the plungers must be removed. Flash from the intersection of the bearing hole and the slot is "knifed" off and the flash at the parting line is removed by tumbling in wood chips. The plungers for the wall type telephones are similarly molded of general purpose phenolic.

The new ringer for the telephone is a high impedance type. Its coil is wound on a molded spool form, and together with the use of electrical grade cellulose acetate insulating washers and tapes, insures complete freedom from electrolysis. To provide sufficient strength with minimum wall thickness, the material selected for the spool was rubber-modified phenolic. Two small terminals are molded in the front spoolhead in a four-cavity mold. The square core is made by a stationary vertical member in the mold and the entire outer surface except the top and the bottom is formed by split wedges. Except for a slight flash removal at the press, these spools are ready for production as removed from the mold.

Impervious to Moisture

Coil and capacitor for the new telephone are assembled, like the earlier model, in a molded phenolic case filled with hydrolene. The unit is impervious to moisture and gives exceptional service even in hot, humid climates.

The connections to the coil windings and the capacitors are made through 20 inserts staked in the phenolic case after molding. These inserts are turned from square brass rod leaving a square head which seats between molded barriers on top of the case and prevents the insert from turning. An undercut on the other end makes it easy to stake the insert in place.

All wiring is done with vinyl insulated stranded conductors with all connections made by means of solderless spade-type tips. The insulated conductors used in both the line cord and the handset cord have been covered with an outer "basket-weave" braid of black nylon as durable protection against the considerable wear and abuse to which both of these cords are normally subjected.

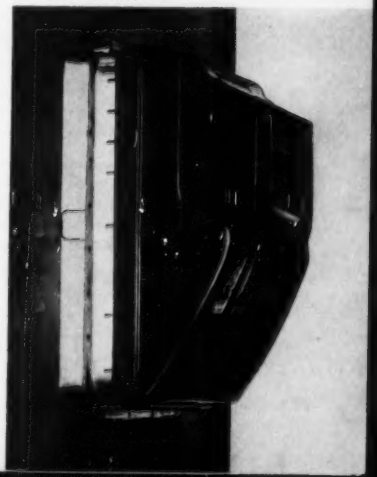
Telephone can be converted to wall use by switching phenolic plungers

Photos courtesy Stromberg-Carlson Co.

Butyrate housing has two molded-in inserts for attachment to base

Housing as it appears on the force plug after mold has been opened

Courtesy General Electric Co.



Molded Plastics Plus

Fig. 1—Dimensions of styrene TV escutcheons are carefully inspected after molding. Conformance of dimensions to pre-determined specifications is necessary to the success of the precise finishing operations

Fig. 2—To prevent crazing, parts are annealed in an electrically-heated oven. By controlling temperature and time in the oven, this operation brings parts to a normal degree of shrinkage, thereby closing any slight welds in the piece into which the paint might seep

THE glamorous metallic finishing of molded styrene has been developed by Erie Resistor Corp., Erie, Pa., into a precise and an intricate technique.

A television escutcheon is an example. After being molded (Fig. 1) as a translucent piece and then annealed (Fig. 2), the unit, which will be used by Raytheon Television and Radio Corp., Chicago, Ill., is run through a series of closely controlled finishing operations—hot foiling; spraying; vacuum metallizing; and painting.

Calibrations are first hot foiled in maroon on the dial band and translucent ivory paint sprayed over it.

The band is then masked off and a gold tint is sprayed over the back of the dial (Fig. 3). Another masking shield is then applied and a silver backing is vacuum metallized over parts of the gold (Fig. 4).

A protective paint coating (Fig. 5) and buffing (Fig. 6) completes the operations. Finished escutcheons are carefully inspected (Fig. 7) before final distribution.

*Erie Resistor Corp.

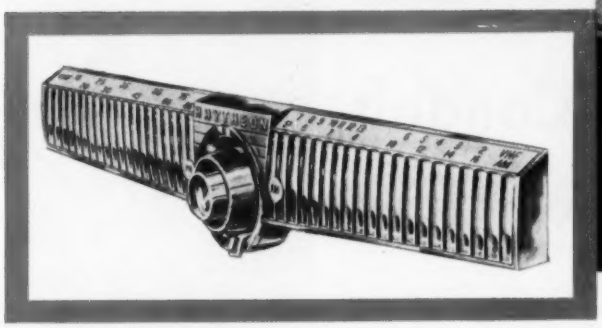
Fig. 3—After annealing, parts are transferred to a rack where operator sprays gold tint over the reverse side. Those areas which are not to be tinted are masked off. Spraying takes place in an air conditioned room to hold presence of dust to a minimum

Fig. 4—Parts are again inspected after they have been given a silver backing in the 48-in. D.P.I. vacuum metallizer seen in the background. This silver layer adds depth to the tint, producing the appearance of actual gold plate. Areas not to be plated are shielded off

Precious Metals

Attractive coloring—gold, silver, and maroon—is added to television escutcheon by series of closely controlled hot foiling and plating operations

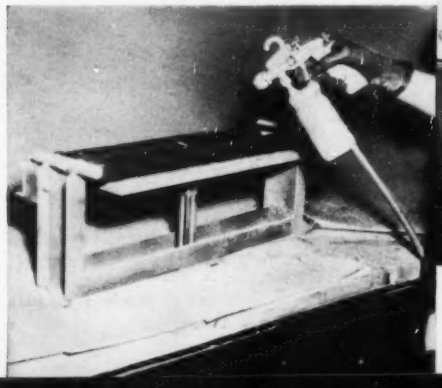
by JACK B. LOEFFLER*



Molded styrene escutcheon (above) serves as attractive tuner for TV set (above, right). Maroon calibrations on dial band and two buttons near dial knob are hot foiled on, then sprayed with translucent ivory. Center section of escutcheon is sprayed with gold tint and silver plated. Remainder of unit is gold tinted

Fig. 6—Buffing the escutcheons requires delicate handling by the operator. Too much pressure will cause burn marks on piece; too little pressure fails to bring out a high luster

Fig. 5—Television escutcheon, with surface again masked off to expose only desired areas, is sprayed with a special backing coat of gray paint designed to protect the plated portions of the piece from later becoming tarnished



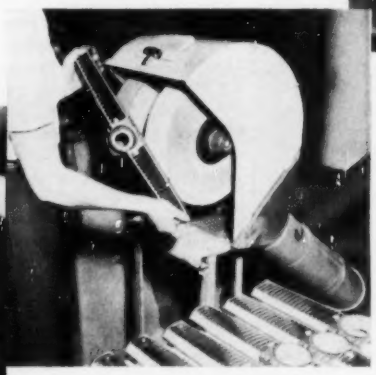


Fig. 7—At the final inspection station, finished television escutcheon is closely examined for the proper positioning of the color units and for the smooth, uniform application of tint, plating, and protective coat of paint

Six 20-ft. lengths of 2-in. butyrate pipe for conduit are carried by one man

Lighting pole will be installed over two 90-degree bends in butyrate pipe

Photos courtesy Tennessee Eastman Co.

Butyrate Conduit for Power Lines

PLASTICS pipes have come a long way—and indications are that they will go further yet.

The successful use of plastics piping in oil fields, gas systems, and water distribution lines have already prompted industrial exploration into its possible application in other fields.

Now, for the first time, extruded Tenite II cellulose acetate butyrate pipe is being used as an underground conduit for power lines. The development is a test project undertaken by Kingsport Utilities, Kingsport, Tenn., in cooperation with Tennessee Eastman Co. and involves a trial installation in one brightly-lit city block. Twenty-ft. lengths of the 2-in. butyrate pipe were used to replace conventional 5-ft. conduit sections made from a compound of asbestos and cement.

In power line conduit, as in other industrial applications, the butyrate pipe offers advantages of flexibility, ease of installation, corrosion resistance, light weight, and high impact strength.

The trenches for laying the pipe were dug by a mechanical ditch digger which simply scooped up clay and shale rock. Because of the pipe's flexibility, the trenches did not have to have the exact straight-edge sides and base which are required for rigid conduit.

To join two sections of pipe, a thinner was first brushed on the inside of a coupling sleeve and a Tenite II cellulose acetate butyrate cement on the pipe ends. The pipe ends were then slipped into the sleeve and, after drying for 30 min., a sturdy joint that prevented any possible leakage was effected.

Once the pipe had been laid in, a backfill of brick, rock, and other heavy material was tamped in over it. Unlike the asbestos-cement pipe which is normally used for power line conduits, there is little danger of the butyrate pipe breaking when struck by a tamping bar.

The installation of 247 of the 2100 ft. of pipe used in the project took a two-man crew only 20 min. to perform. The speed was primarily due to the pipe's light weight, which enabled the workers to lift and carry as many as six 20-ft. lengths of the pipe at one time.

Two pipe sections are joined with a butyrate cement and a coupling sleeve

Semi-automatic forming machine used in pilot run job has two beds 40 by 60 in. in area; maximum depth of draw is 8 inches

Pilot Set-Up for Vacuum Forming

TO anyone who has not studied techniques for vacuum forming of thermoplastic sheet materials, the operation has a deceptive simplicity. Actually, the ease and speed of the operation result as much from improved know-how as from modern equipment.

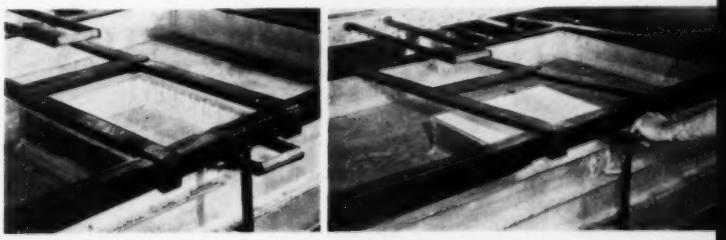
At the Nosco Plastics plant, Erie, Pa., a modern semi-automatic vacuum-forming machine has been installed. The unit, made by Industrial Radiant Heat Corp., New York, N.Y., is one of the largest in existence and has two beds, 40 by 60 in. in area with an 8-in. maximum depth of draw.

To show the principle of operation, Nosco engineers set up a pilot run job, involving much less area than the machine can handle. The unit is an evaporator tray cover for refrigerators and on a production run would be done in six cavities.

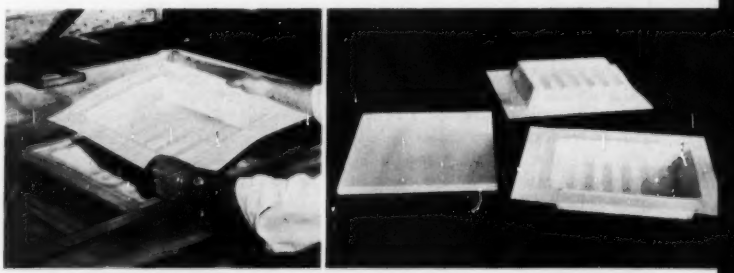
The mold itself, which is cast stone metallized by the spray process, is placed in a wood frame carefully gasketed to the operating base of the press to prevent leakage of air. Over the top of the mold and its frame goes a sheet of modified styrene material to be formed. An adjustable steel clamp with a sponge rubber gasket bonded to its bottom face clamps the sheet in place.

Following the clamping, the heating element is pulled forward over the sheet on top of the mold and, by automatic timing, vacuum is applied from below when the sheet has reached its desired degree of softness.

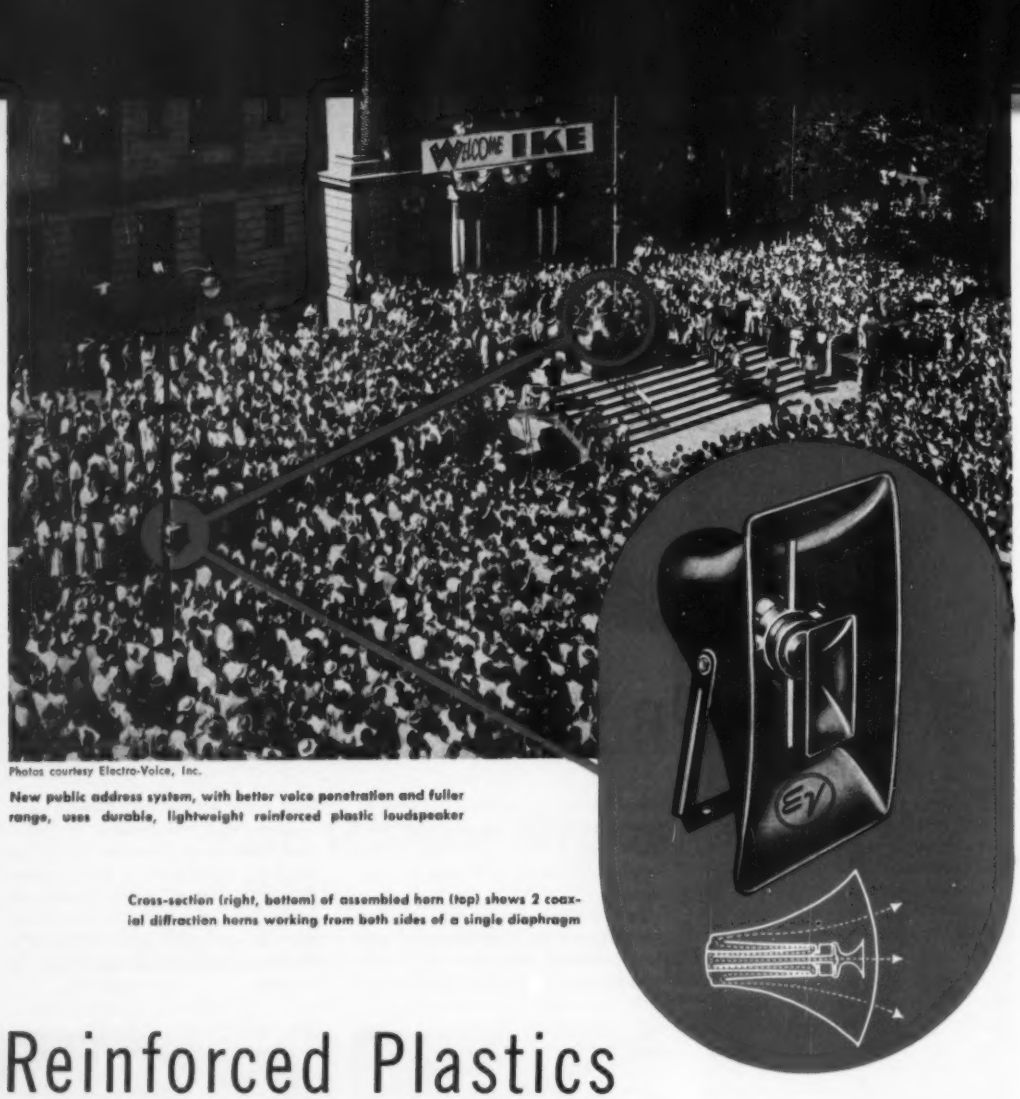
Involved in successful vacuum forming are such matters as "pattern" heating by means of baffles which permit various degrees of heat to be applied to different parts of the sheet, adjustment of hold-down clamp to prevent shrink of sheet on heating or to permit some desirable slippage where draws are very deep, and relationship of degree of heat and time of cycle to thickness and type of material to be formed.



Mold (left) is covered with sheet clamped in place (right). Heat and vacuum are then applied



Formed piece is removed from mold (left); sheet stock and formed pieces are shown at right



Photos courtesy Electro-Voice, Inc.

New public address system, with better voice penetration and fuller range, uses durable, lightweight reinforced plastic loudspeaker

Cross-section (right, bottom) of assembled horn (top) shows 2 coaxial diffraction horns working from both sides of a single diaphragm

Reinforced Plastics in a Revolutionary Loudspeaker

THE philosopher Plato once commented that a man could hope to rule all who could stand within range of his voice. It is interesting to note that, regardless of the appeal of radio, and even of television, the public still desires to see and hear its leaders in person.

So, in the recent presidential campaigns, each candidate and his supporters used voice-carrying devices to increase the number of people who could hear him on personal appearances.

Contributory to this objective was a revolutionary compound voice projector development by Electro-Voice, Inc., Buchanan, Mich. This device is literally an electronic super-loudspeaker, declared to deliver 2½ octaves more musical range than usual public address systems of even larger size, and offering 20% superior listening to the spoken word. The diffraction principle provides much greater sound dispersion and coverage with fewer loud speaker units and at less cost.

Having created this unique PA speaker, the makers cast about for further dramatic improvement and decided to make each speaker unit weather proof, not easily broken, and light in weight. Reinforced plastics were the obvious material choice. The job was put into development by Molded Resin Fibers Co., Ashtabula, Ohio.

As with all good reinforced plastics jobs, all previous concepts for design in metal had to be discarded. Engineers on the staff of Electro-Voice, Inc., working with the molder, came through with a shape design that could be readily pre-

formed and one that would release handily from the mold.

When design had been set, a wooden male pattern for the horn was produced by the Ohio Pattern Works, Cleveland, Ohio, and this was sent to the American Brakeshoe Co.'s Casting Div. in Rochester, N. Y., where the female cavity was precision cast in special alloy iron. The male was cast in the same material and machined on a Keller automatic. The mold was mounted on a 100-ton reinforced plastic press developed by Erie Engine and Manufacturing Company, Erie, Pa., in collaboration with Molded Resin Fiber. This press has a 64 in. daylight and a platen area of 49 by 55 inches. Preforming was done on the company's own specialized preformer which uses a glass roving chopper, a blower, a flexible metal hose, and a Venturi tube to deliver fibrous glass and polyester emulsion binder onto a punched metal preform mandrel as shown in the photograph at the right.

The finished preform has a 3/16 in. steel wire bead inserted into the leading edge in course of "building up" the preform. Material content of the finished molded piece is 40% polyester resin, 30% fibrous glass, 28% calcium carbonate, and 2% preform binder.

Preform Preheated

The completed preform is placed in an oven for three minutes at 450° F. and then dropped into the female cavity, where the polyester resin is added and the mold closed under pressure.

The mold used in this case is the "shear" type, preferred for metal-to-plastics molding of reinforced plastics; since the parting line is most accurate, little or no finishing is required.

The resulting speaker horn is practically unbreakable, is less than half the weight of a similar unit made of metal and thus does not require such strong supports, is economical to transport and to install, and is rapidly increasing in popularity.

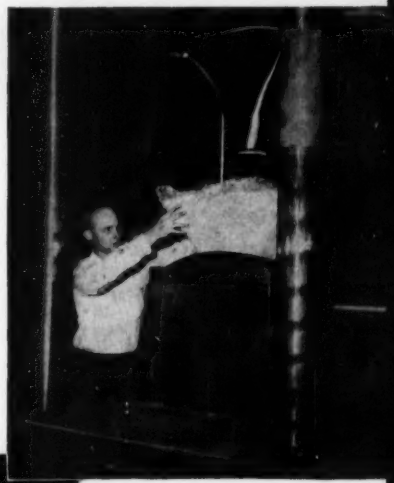
Plato was born about 2500 years too soon.

Dramatic improvement is given to public address system by a weatherproof, lightweight reinforced plastics loudspeaker

Photos on this page courtesy Molded Resin Fibers Co.

Spraying binder and blowing fibrous glass is an early step in building preform

Finished preform, with metal bead inserted in edge, is put into curing oven



Cured preform, removed from oven, is dropped into cast steel female cavity on the press

After weighed polyester resin has been added to the preform in the mold, pressure is applied

Completed horn, weighing half as much as similar metal unit, can support weight of a 200-lb. man

Using a lifting tool, operator removes finished speaker horn from the mold

Special fibrous glass cable gives high uni-directional strength to matched die moldings

by EDWIN F. BUSHMAN*

Reinforcing

Photos courtesy Electro Insulation Co. and Insulation Mfrs. Corp.

Fig. 1—Close-up of fibrous glass cable showing the roving bundle and the fibrous glass braided sleeving. The 490,000 glass filaments in the bundle are condensed to ⅛ in. diameter and tightly enclosed within the sleeving

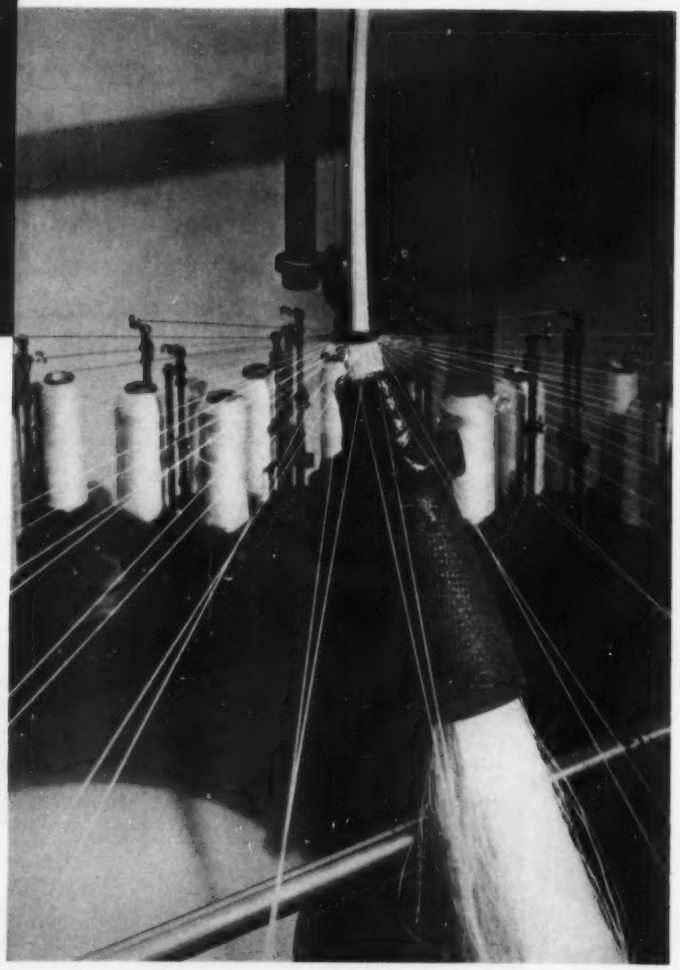
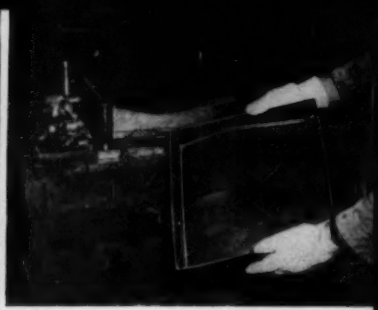


Fig. 2—Production set-up for manufacture of glass cable. Roving fibers are drawn from below the braiding machine and pass through a tube into the steel die that condenses them. Glass fiber strands are then drawn from braiding spools and woven around bundle



Photos courtesy General American Transportation Corp., Reinforced Plastics Dept.

Fig. 3—In molding parachute seat, cable, impregnated with polyester resin, is positioned in mold

Fig. 4—Fibrous glass preform is placed over cables, impregnated, and then molded in press

Fig. 5—Cables give molded part unidirectional strength in areas of greatest stress

REINFORCED PLASTICS

THE high unidirectional strengths and moduli of fibrous glass polyester fishing rods have now been applied to matched die molding of glass fabrics and preforms by the Reinforced Plastics Dept., General American Transportation Corp. The use of specially manufactured glass cables has enabled this firm to engineer unidirectional strength into preform products with locally oriented tensile strengths and flexural moduli approximating those of reinforced plastics fishing rods.

These cables can be designed into parts across areas of exceptionally high stress, thus permitting designers to reduce the main wall sections of structures to the minimum thicknesses required for ordinary wear and structural unity. In this fashion the weight of heavily stressed products can be kept to a minimum, without the use of troublesome metal reinforcements or difficult assemblies.

In experimentally developing a highly stressed, lightweight parachute "explosion" seat for the Air Force, General American engineers concluded that unidirectional reinforcement extending entirely across the area of maximum flexure would prevent rupture and failure of the product.

Drop testing proved the calculations to be correct, and production methods of achieving such unidirectional reinforcing were studied. A large number of techniques were tested experimentally. These included sewing a ⅜ in. diameter bundle of fibrous glass roving within strips of glass cloth; also impregnating the roving bundles with various types of polyester and alkyd resins, and twisting to keep the bundle together. However, best handling properties were found to be achieved by drawing the ⅜ in. roving bundle within a length of ⅜ in. diameter glass braided sleeving, as in Fig. 1.

Upon completion of this experimental investigation, a contract was awarded to Insulation Manufacturers Corp., Chicago, for braiding production quantities of this special glass cable in the Electra Insulation Co. plant, Woodside, L.I., N.Y. Several experimental runs were made, with each sample braid being tested for its impregnating and molding efficiency in General American's reinforced plastics plant. On the completion of tests a production setup was made in the Electra plant, as shown in Fig. 2. Here fibrous glass roving is drawn simultaneously from 40 balls of roving. This loose assembly of approximately 490,000 glass filaments is drawn from below a 56 spindle New England Butt Co. braiding machine. The fibers are drawn through a collimating tube, then condensed to ⅜ in. diameter by a small steel die. As shown in the illustration, one glass textile fiber strand from each of the braiding spools is drawn per standard braiding procedure, through the ⅜ in. die and woven over and around the roving bundle.

In molding parachute seats in the General American plant, 15 in. lengths of this special glass cable are pre-impregnated with pigmented polyester resins, and delivered to the molding press for use. Placement of these unidirectional cables in the molded part has been done in several different ways, one of which is illustrated in Fig. 3. As shown, the impregnated cable is positioned in a recess in the steel mold by pressing it on to sharp pointed steel pins which are located along the axis of the desired reinforcement. Satisfactory results have also been obtained with desired time savings by locating these impregnated cables in the preform itself prior to placing. As shown in Fig. 4, the fibrous glass preform is positioned over the unidirectional cables on the punch of the steel mold. Following impregnation and molding, as illustrated, the part is removed from the press. Figure 5 shows location of the unidirectional glass cable along the two under-side corners of the "explosion" seat, in the area of most severe flexing.

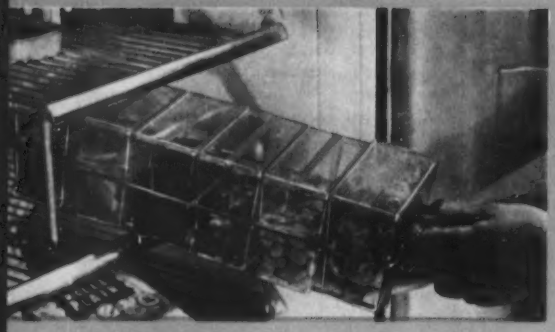
In this fashion homogeneous strength can be molded into a part with a wall section of as low as 0.060 to 0.070 in., with strategically placed unidirectional sections three to five times greater in strength, in thicknesses as great as ½ inch. Satisfactory explosion and drop testing resistance of the molded seat to shocks exceeding 40 G's has been achieved, while keeping the weight of the molded part at 4 to 8 oz. below the maximum allowed weight of 2½ pounds.

* Technical Director, Reinforced Plastics Dept., General American Transportation Corp., Chicago, Ill.

Realistic horse's head molded of Vinylite plastisol resins can be attached to a youngster's bicycle or scooter, transforming it into a lively, bucking "bronco." The sturdy material, which resists salt water and the abrasive action of sand, permits the unit to double as a beach toy. A shoulder harness is available to fasten the head to a child's chest. The unit is offered in white, brown, grey, or black by Cornell Industries, Inc., 193 Bradford St., Brooklyn 7, N. Y.

Flying saucers capture the imagination of children in this toy gun and spinning tops molded of high impact styrene. The light, durable top, which is attached to the head of the gun and ejected by a trigger action, flies high into the air and falls in a whirling motion to the ground where it continues spinning. Three tops in contrasting colors are supplied with the gun. The toy is molded by the U. S. Plastic Co., 2570 E. Walnut St., Pasadena 8, Calif.

Plastics

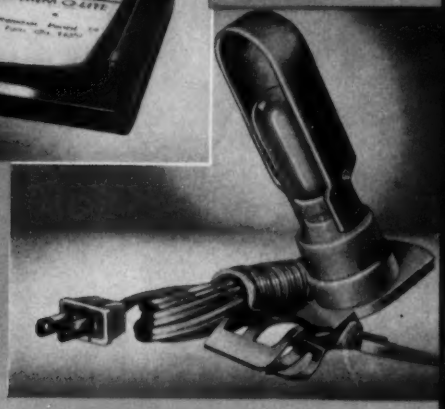


Leftovers and canned foods can be neatly stored in a minimum of refrigerator space by using a series of six 4-in. clear styrene containers that fit into a wire basket. Each of the containers can accommodate about one pint of liquid or the contents of a No. 2 can, and is equipped with a close-fitting lid, also molded of Bakelite styrene. A four-container unit and holder is also available. Produced by Valley Forge Creations, King and Bridge Sts., Malvern, Pa.

In traditional style, a champagne glass blown from acrylic sheet incorporates a hollow stem, which insures a steady stream of tiny bubbles bursting to the surface. The transparent glass is used for service to passengers travelling British European Airways and is engraved with the company's emblem. The glass, blown in two separate parts which are then welded together, is made by B. Attewell and Sons Ltd., Reflection Works, Southall, Middlesex, England.

A combination of a memo pad and pencil resting on a 5 by 7 in. Plaskon urea base, and a lamp attached to one corner of the base results in a unique desk or telephone table set. When the pencil is removed from its slot, the lamp is automatically turned on, lighting the memo pad. Replacing the pencil turns the light out. The colorful unit is molded by Kopplin Molding Corp., 1440 Blair St., St. Louis, Mo., for All-Purpose Supply Co., 7309 Ash, Kansas City 15, Mo.

Vinyl-coated metal clamps attached to a utility light allow the unit to be clipped to bedposts, sewing machines, drawing tables, or wherever else it might be needed. The vinyl coating furnishes a non-slip grip, especially on polished wood, and prevents the clamps from any unsightly marring of the surface. Both the housing and shade of the utility light are molded of phenolic. The manufacturer is Cable Electric Products, Inc., 234 Daboll St., Providence 7, R. I.

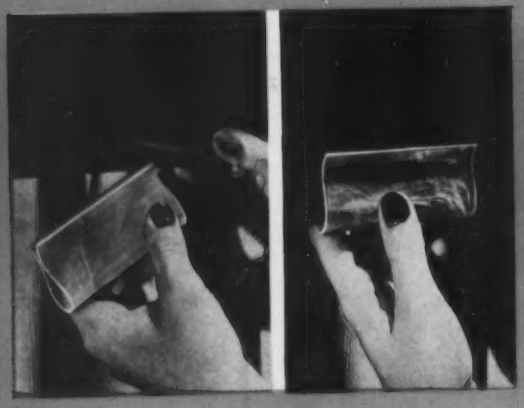


Products

Wide-necked polyethylene funnel with a wire handle fits over the top of a paint can to prevent brush drippings from running down the outside of the can and to serve as a brush rest, wiper, and can carrier. The flexibility of polyethylene permits the unit to be easily attached and removed. By merely flexing the device, called Paint-Boy, hardened paint can be flaked off. The frosty white unit is from Norloc Div., Norton Laboratories, Inc., Lockport, N.Y.

For seeing what's ahead in stormy weather, a clear panel of transparent Vinylite film is firmly set into the nylon or acetate fabric of a new Window Umbrella. The moisture- and abrasion-resistant Vinylite has the added advantage of resisting cracks and creases of repeated umbrella foldings, thereby helping to keep vision clear at all times. The umbrella is made in several colors by Rainseth Umbrella Co., Inc., 26 W. 31 St., New York 1, N. Y.

Self-sticking, transparent merchandising signs made from Celanese cellulose acetate film have pressure-sensitive adhesive strips for adhering the signs to any surface. To use, protective tape is peeled off the adhesive strips and the signs simply pressed on. The adhesive is located both on the face and the reverse of the re-usable signs to permit their use either on windows or on opaque surfaces. By Goodren Products Corp., 136 W. 21 St., New York, N. Y.



To protect window shades against rips, tears, or finger smudging, a clear Bakelite styrene shade pull can be slid over the bottom slat of the shade and used as a hand grip. The lightweight, tough 3½-in. long pull is molded with smooth, rounded edges that fit the hand comfortably and prevent fingers from punching through the shade material when shades jam or are drawn down quickly. It is made by The Winette Co., 2500 Harriet Ave., Minneapolis, Minn.

Plastics

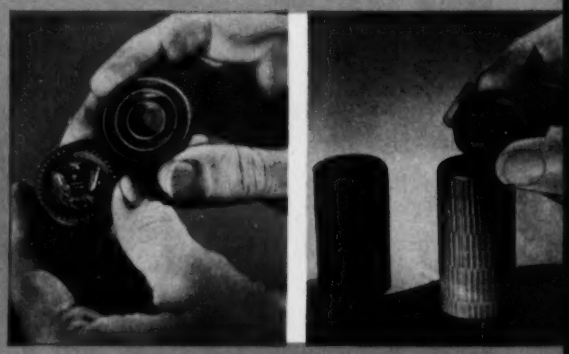
Double-duty egg container and egg dispensing unit is molded of styrene in red, white, or crystal colors. As each egg is removed from the end of the unit, the next one automatically rolls into the easily accessible position. The containers will hold at least ½ doz. eggs of all popular sizes and can be securely stacked upon each other or side by side. The unit, which is called the Egg-O-Matic, is manufactured by Beacon Plastics Corp., Newton Highlands 61, Mass.

For use when travelling, fishing, or attending sports events, an unbreakable polyethylene pocket flask also offers its unique service as a practical and automatic measure. On squeezing the conveniently shaped flask, exactly one oz. of the contained liquid will be measured into the neck ready to be poured. The sanitary, washable unit, called Squeeze-A-Jigger, has a metallized finish. Made by Squeezit Corp., W. 177 St. and Harlem River, Morris Heights 53, N. Y.

Products

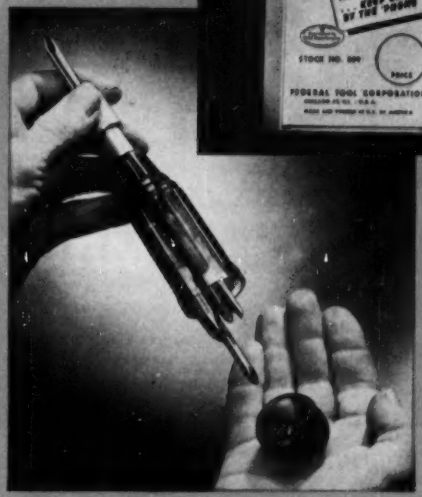
By regulating water pressure, a perforated garden hose, made of metallic green vinyl, can be used as a sprinkling system or as a slow soaking unit that permits proper saturation of the soil. Under low pressure, the water seeps through the perforations, located at regular intervals along the hose; under high pressure, the water is sprinkled into the air as a fine spray. The manufacturer is American Extruded Products Co., 1023 N. La Brea Ave., Hollywood 38, Calif.

Checkers molded of durable black Bakelite phenolic, are shaped to firmly interlock with each other so that the pieces will not slip either when a "king is crowned" during play or while the "men" are being stacked off the board. The checkers will resist chipping, splitting, or breaking, and can easily be washed clean. The checker pieces are molded by Elgo Plastics, Inc., Chicago, Ill., for distribution by Halsam Products Co., 200 Fifth Ave., New York 10.



A decorative as well as a useful kitchen reminder molded of styrene consists of two adjacent holders—one for either a 3 by 5 in. memo pad or similar size recipe cards; the other for a handy pencil. Topping the holder is an attractive silhouette design of a dog with a market basket hanging from his mouth. The pad holder is available in chartreuse or canyon clay colors and is molded of Styron by the Federal Tool Corp., 3600 West Pratt Blvd., Chicago 45, Ill.

All purpose screw driver carries a set of eight different bits in its hollow Tenite II cellulose acetate butyrate handle. Molded in transparent blue, the tough handle is fluted for easy grip and has a screw cap which permits ready access to bits stored within. Chosen bits are held securely in place at the business end of the screw driver by tightening a knurled nut. The unit, called the Uni-Driver, is manufactured by George Cluthe Mfg. Co., Kitchener, Ontario.



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Molding Eliminates Sewing

Automobile seat cushions and interior side panels now being produced for a number of car manufacturers, including Chrysler, Plymouth, and Packard, by a method which reduces costs and increases wearability

Above and right: Three views of the interior of a 1952 Plymouth suburban model in which the seat cushions and the side and door panels are produced by the plastics molding technique described in the accompanying article. Mold design is simple, mold cost is low

NOW being used in the manufacture of automobile seat cushions and interior side panels, a new plastics molding procedure has completely eliminated sewing, tying on of upholstery buttons, and mechanical assembly of decorative metal strips by means of metal clips. This new system has radically reduced labor costs, increased wearability, and made possible unlimited design possibilities with cost of change-over from one design to another practically nil.

Developed under the guidance of A. W. Prance, director of design, research department, Briggs Manufacturing Co., Detroit, Mich., and now set up on a high-speed production line, this procedure is being used to produce cushions and panels for many leading cars, including Chrysler, Plymouth, and Packard.

Supported and unsupported vinyl, upholstery cloth, leather, or synthetic fabrics can be used interchangeably or in combination with each other with little if any variation in production techniques. The process in its simplest terms consists of laying up a sandwich of filler layers, backing and facing materials, molding this sandwich in a mold constructed to the desired design, and at the same time molding on the chrome metal trim.

Sandwich Impregnation

The first operation consists of impregnating certain of the sandwich filler layers with a bonding agent. For the panels, an alpha-cellulose paper is impregnated with a special liquid phenolic resin made by Reichhold Chemical Co., Detroit, Mich. A pick-up of about 60% by weight is required, and this percentage is controlled by the viscosity of the liquid resin. For the cushions, tobacco cloth is impregnated with a synthetic latex with about a 50% pick-up (Fig. 1). In both cases, the web is then passed through an oven which partially cures the impregnant so that it is no longer tacky. The oven temperature is held at 350° F., and the web requires about three minutes to pass through the oven, after which it is rolled (Fig. 2).

If simple rectangular or square shapes are required, the material is passed through a rotary cutter (Fig.

* Reg. U.S. Pat. Off.

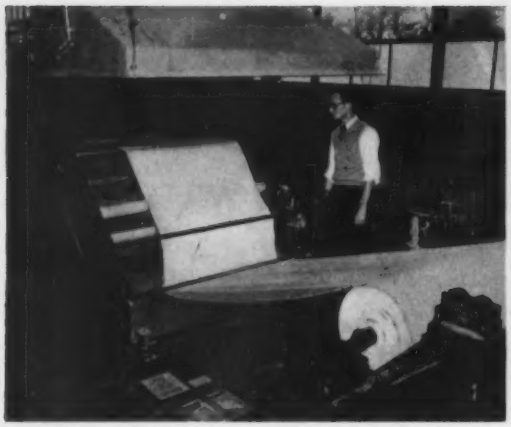


Fig. 1—Tobacco cloth is impregnated with liquid resin

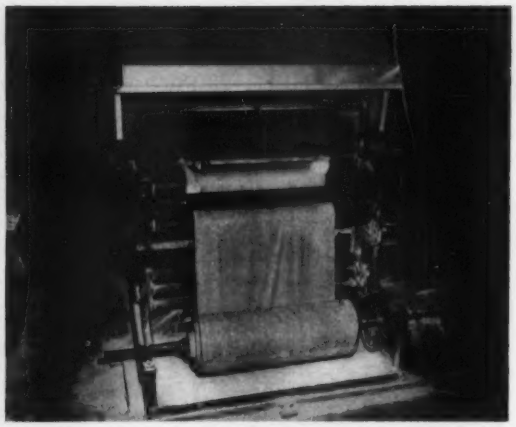


Fig. 2—After partial cure in an oven, web is rolled on mandrel

Fig. 3—Rotary cutter is used where simple shapes are required

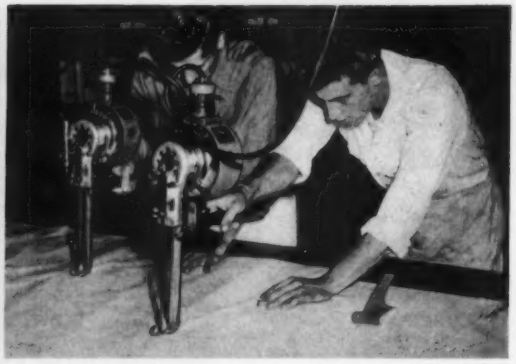


Fig. 4—Garment industry technique is used for complicated shapes

Fig. 5—After layup is made, excess over-hang of facing is trimmed

Fig. 6—After trimming, layups are taken by conveyor to spray booth

3), the slitter and cut-off knives of which have been set to give the required dimensions. For complicated shapes, the technique used in the garment industry is employed. That is, stacks of the same type of material are laid up on a long cutting table, and the desired pattern is marked out on the upper layer of the stack. Vertical vibrating knife cutters (Fig. 4) are used to cut these stacks to pattern.

Stacks of the various types of materials needed for the side panel sandwiches are then delivered to the layup department, while the stacks of pattern-cut materials required for the cushions are delivered directly to the molding department.

Side-Panel Layup

In the layup department (Fig. 5), operators lay up the required number of layers of each material for all types of side panels. In the completed sandwich layup, the various components are lightly held in position by stapling.

For the panels, the outer layer of materials may be vinyl, cloth, leather, or a combination of any of these, according to the design. Next under the facing is the wadding, which may be layers of cotton, paper, foam rubber, or hair. The next layer is phenolic-impregnated alpha-cellulose paper, and finally the foundation board, which may be Masonite or asphalt board.

After the layups have been assembled, operators trim some of the excess over-hang of the facing layer, allowing from ¾ to 1 in. of overhang to remain (Fig. 5). The layups then travel down a moving belt (Fig. 6) to a spray booth, where the operator sprays the outside edge of the backing panel, as well as the protruding portion of the facing material, with a latex adhesive (Fig. 7). The layups then travel through a drying oven where the adhesive becomes tacky. The moving belt then carries these panels to a group of operators who fold over the protruding edges of the facing material and slick them down against the foundation board (Fig 8). These layups are now ready for the molding operation.

Bonding Metal Strips

In order to make possible bonding of the decorative chrome metal strips to the side panels, a phenolic-impregnated alpha-cellulose paper strip is used in conjunction with the metal strips. After the paper has been impregnated, partially cured, and slit to the desired widths, a roll of this paper strip is placed in its proper location on a special Tisken roller machine (Fig. 9). A second station on this machine receives a roll of metal strip, chrome-plated on one side. The machine feeds the paper onto the unplated side of the steel strip, and as this combination proceeds through the machine the edges of the steel are rolled over 180° and crimped down against the edge of the paper, thereby holding it firmly in position. This paper-steel assembly is then automatically cut into the required lengths and delivered to the molding room.

The development of this method for assembling the decorative metal strip to the side panels is one of the more important advances which have been made in the interior decoration end of the automotive industry for a good many years. This patented* method has eliminated the use of all metal clips or prongs on a retainer strip which were formerly necessary for the assembly. These metal prongs were pushed through holes in the side panel and turned over on the back to complete the assembly. An additional advantage is that, whereas the old method of assembly required a chrome-plated steel strip averaging about 0.025 in. in thickness, the new strip needs to be only 0.008 in. thick. Thus the process not only simplifies assembly but it also contributes to lowered costs by reducing the amount of metal needed per unit.

Figure 10 shows one side of a Watson-Stillman multi-platen press, with slides so arranged that the mold for each opening can be pulled out from between the platens for loading and unloading. The opposite side of this press is similarly equipped, so

* U.S. Patent No. 2,581,195

All photos with this article courtesy Briggs Mfg. Co.

Fig. 7—Spraying adhesive on edges of backing panel and facing sheet

Fig. 8—Edges of facing material are folded over against backing panel

Fig. 9—Trim strip is here crimped over phenolic-impregnated paper

Fig. 10—Molds can be pulled from either side of multi-platen press

that with two operators the molds on one side can be loaded and unloaded while the layups from the opposite side are being cured.

Design Bars

The molds themselves consist simply of a ⅛-in. thick steel plate to which have been screwed narrow strips of steel known as the "design bars." These bars are 1 in. high, and of a thickness required by the design. The lower portion of each upper steam platen becomes the second or upper half of each mold.

The development of this type of mold was of the utmost importance, since in most molding operations mold costs are a very important factor. Because of the simplicity of this construction, practically any design can be produced. A fair estimate for a mold might possibly go as high as $150 for a very complicated design. Each lower portion of the mold is also equipped with flat steel strips to hold the decorative chrome steel strips in position. Each end of these mounting bars is raised, so that the strips cannot slide during molding.

Figure 10 shows the operator loading chrome metal strips into two side panel molds. These strips are loaded with the phenolic-impregnated paper side upward. After the metal strips are loaded, the operator places a sandwich layup, outer face downward, against the designed portion of the mold (Fig. 11). In this position the outer layer, consisting of upholstery cloth and vinyl, comes into direct contact with the phenolic-impregnated paper which is incorporated in the back of the chrome plated decorative strip. After the press is opened, and the operator on the opposite side has removed his set of molds, the loaded molds are slid into position between the platens of the press. The complete molding cycle is automatic, and only requires that the operators on both sides press the starting buttons simultaneously. This is a safety feature which eliminates the possibility of an operator on one side of the mold inadvertently starting the press closing at the wrong time.

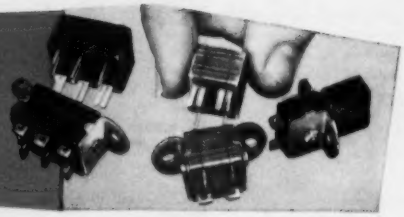
During molding, the steam platens

Fig. 11—After metal strips are loaded into side panel molds (see Fig. 10), operator places layup, outer face downward, on mold

Fig. 12—Removing completed panel with molded-in design

Fig. 13—Ends of trim strips are bent and pressed against back of panel

Increase Production...Cut Costs of Close-Tolerance Plastic Parts



The new Stokes Model 800 fully automatic 15-ton press at Elco Corp. Parts are produced at unusually high speed, exceptionally low cost. At top are shown Elco "Varicon" miniature connectors that "work like giants"; note the detail of the precisely formed parts.

Elco Corporation, Philadelphia, Pa., is now molding its "Varicon" electrical connectors on a Stokes Model 800 fully automatic plastics molding press. End and center sections of the "Varicon" are molded from phenolic, alkyd or urea . . . then assembled in a multiple to dovetail perfectly with other sections and contacts. Obviously, critical tolerances must be maintained.

Stokes new Model 800 fully automatic plastics molding press is the fastest, most flexible and versatile press of its type now on the market. Designed to handle all thermosetting plastics, including alkyds without press modification, it operates on a cycle time of only 5 seconds, exclusive of curing.

One man can handle a battery of Stokes fully automatic presses, reducing labor cost to a minimum. Their high speed, and flexible, foolproof, economical features greatly simplify molding practices and assure high production of perfect, uniform parts.

If you want to know how fully automatic molding can help you increase production and cut costs, send parts or blueprints to the Stokes Advisory Service for free analysis and report on their suitability to fully automatic molding. Also send for the Stokes 24-page brochure on Fully Automatic Molding.

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Fig. 14—Loading mold with a layup which will produce the cushion and back of an automobile seat in one molded piece

Fig. 15—Sliding cushion mold out of press. Upper side of the molding will be under side of installed upholstery

Fig. 16—Removing a cushion from the mold

Fig. 17—Trimming excess material from the edges of a molded auto seat cushion

are held at 340° F. and the over-all cycle is only 1½ minutes.

As shown in Fig. 11, there is no pattern or design on the layup being placed in the mold. Figure 12 shows the completed panel just as it is removed from the mold. Note the perfect design, the lines of varying widths, and the fact that the chrome plated trim strips are firmly bonded in position.

The molding operator next places the panels on a moving belt where they pass to operators who perform the final job, which consists of bending the protruding ends of the metal strips and pressing them firmly in position against the back of the panel. They are then placed in carriers on an over-head conveyor system (Fig. 13) which takes them to final inspection and shipment.

Cushion Layups

In the case of cushions and backs, the molding operation is very similar, with the exception of the fact that the sandwich layups are made adjacent to the press. They consist of an outer facing, which may be the same as is used for side panels. Just under the facing is a layer of impregnated tobacco cloth. Next comes the cushioning layer, which may be from ⅜ to ¾ in. thick, and may be composed of foam rubber, rubberized wool, or two thinner layers of each, according to the quality of the cushions being produced. Next comes another layer of impregnated tobacco cloth. The under-layer is a 30-to 40-count cloth.

Figure 14 shows operator loading a layup which will produce a cushion and back in one piece. Figure 15 illustrates a molded cushion just as it comes from the press. Figure 16 shows the outer surface of the cushion with its ribbed construction, just as it is being removed from the mold. The outer and inner layers of the edges and depressed portions of the ribs are securely bonded together in an operation that required but about 2 min., as compared with a much longer time which would have been required to produce this design and assembly by means of sewing.

In Fig. 17 the final operation, which consists of trimming the excess material from the edges, is performed, after which the parts are given a careful final inspection and then prepared for shipment.

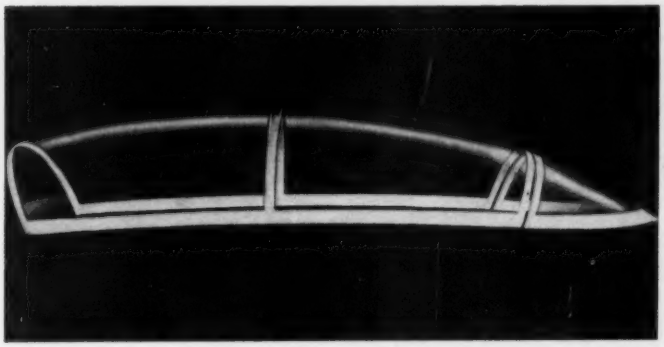
Storage Room for Laminated Acrylic

Moisture absorbed from air by polyvinyl butyral inner layer during storage causes subsequent bubbles and opacity in laminated acrylic. Chemical liquid-type dehumidifier supplies ultra-dry air to storage room

by F. M. JOHNSON*

IT HAS been found by Goodyear Aircraft that an ultra-dry, air conditioned room is required for storage of laminated Plexiglas which is later to be formed into fighter aircraft canopies. In this material, the two outer layers are Plexiglas and the inner layer is a highly plasticized polyvinyl butyral, an extremely moisture-sensitive material. It is because of this hygroscopic butyral that air conditioning is required.

Under normal atmospheric conditions, particularly when humidity is high, the butyral inner layer readily absorbs moisture from the air. To combat this, Goodyear Aircraft now has a storage room for these laminated Plexiglas sheets, maintained year-round at air conditions of 70° F., 15% relative humidity. Although the temperature is not low, the depressed humidity condition prevents moisture absorption by the butyral.



Airplane canopy is formed from laminate of two layers of acrylic separated by a layer of highly plasticized polyvinyl butyral which is extremely moisture-sensitive

Moisture Causes Opaqueness

Excess moisture absorbed by butyral cannot be detected until the flat laminated Plexiglas is placed in heating ovens to obtain a supple material for forming. At this point, such moisture will cause bubbles to develop in the butyral inner layer.

Since Plexiglas canopies must give the finest visibility obtainable, and since bubbling in the inner layer causes opacity, canopies with bubbles are necessarily scrapped. Each canopy represents a material investment of approximately $1000. Therefore, not many laminated sheets can develop bubbles without causing the manufacturer a serious production headache.

A typical 3-ply laminate consists of two layers of 0.15 in. thick acrylic with a 0.20 in. thick inner layer of butyral. The soft inner layer prevents the shattering of the entire structure when it is penetrated by a bullet. Cracks around a bullet hole, which spread in monolithic acrylic sheets, do not spread in this laminated material. Shatter-proofing is, of course, particularly important in planes with pressurized cabins.

It is apparent that perfect visibility for a pilot is of paramount significance. Canopy panels of a decade ago had excellent optical qualities, but the supporting framework added blind areas in the pilot's field of view. The bubble canopy represented a great step forward in the elimination of these blind areas.

The laminated Plexiglas is manufactured in flat sheets by supplier firms under air conditions identical to those which Goodyear Aircraft maintains in its storage rooms to keep the excess moisture away from the butyral.

Canopy Production Steps

Upon receipt of flat laminated Plexiglas at Goodyear Aircraft's plant, it is placed in the air conditioned storage room until required for further processing. As much as $120,000 worth of Plexiglas may be in storage at one time. The temperature in this room may vary from 65 to 70° F.; temperature is not so critical at this point as is the need to maintain a very low absolute humidity of approximately 18 grains/pound.

Steps involved in making the canopies can be stated briefly and simply, but the operating techniques involved are, indeed, more difficult to accomplish. Upon removal from the storage room, the laminate is placed in an oven and heated until a material temperature of approximately 300° F. is reached. It is then removed and placed in a frame for free blowing under air pressure or mounted on the end of a rotating arm for whirling; both of these methods are used to form the supple sheets into the desired canopy shape. This last method, called "Rotoforming," uses centrifugal force to produce the desired shape. After setting and cooling, the flash is trimmed. An edge

* Manager, Kathabar Div., Surface Combustion Corp., Toledo, Ohio

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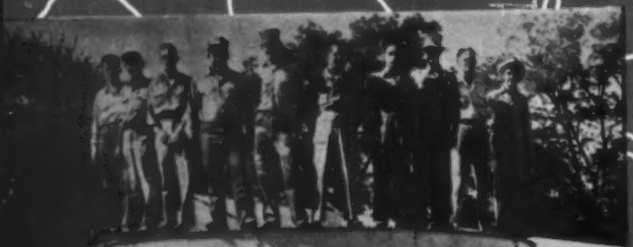

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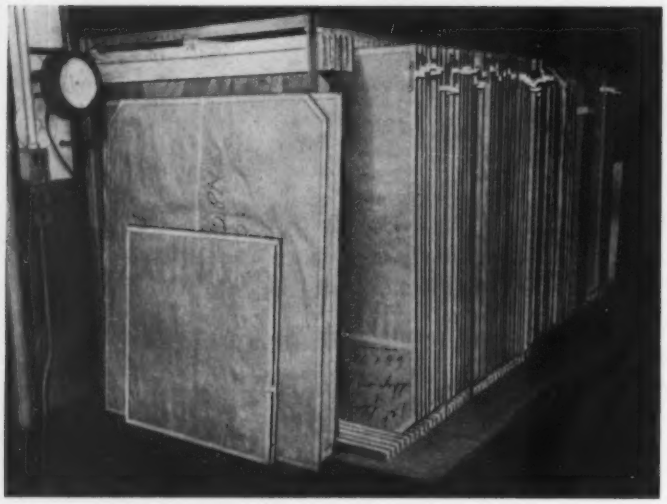


To prevent excess moisture absorption by butyral and consequent formation of bubbles, laminated acrylic sheets are stored in a special low humidity, air conditioned room

attachment is then cemented onto the canopy to complete fabrication and ready it for assembly in a metal frame.

Prior to obtaining the air conditioned storage room, it was necessary to place the laminates in the heating ovens immediately upon receipt at the plant. Production schedules for the hygroscopic material had to be dovetailed to coincide with incoming shipments. It is obvious that such inflexible operating schedules would be unsatisfactory. In addition, since the laminates could not be stored for any length of time, incoming shipments were small and frequent. Now Goodyear Aircraft can order sizable quantities at their pleasure so as to maintain a sufficient supply in storage to meet all the requirements of a flexible and practical production schedule.

To maintain a low humidity condition 24-hr. a day, however, presented a problem. To reach a level of 18 grains/lb. using conventional refrigeration equipment would require cooling the air to a temperature well below freezing in order to condense out moisture. Then a large amount of air reheating would be necessary to arrive at a 65 to 70° F. temperature.

To accomplish continuous operation, moreover, would necessitate duplicate sets of cooling coils, so that one set could be defrosted while the second set performed its primary function. This appeared costly, both from an initial cost and operating cost point-of-view.

Dehumidifier

Therefore, early in 1951, Goodyear Aircraft installed a 2500 c.f.m. capacity Kathabar dehumidifier, built by Surface Combustion Corp. This liquid chemical-type, moisture-absorbing unit accomplishes the desired air results while avoiding the usual below-freezing operational handicaps, such as the shutdowns necessary for defrosting.

A mixture of fresh air and air recirculated from the storage room enters the lithium chloride-base solution dehumidifier at conditions of 73° F. and 27% r.h. This air passes through a spray of the absorbing solution where its moisture is reduced to a predetermined value. At the same time, both air and absorbent pass over Freon-12 direct expansion cooling coils. This has a two-fold effect. First, these coils control the temperature of the absorbent; the colder the absorbent, the greater is its moisture-absorbing power. Secondly, the air is cooled by the coils to obtain the desired delivery temperature of 55° F.

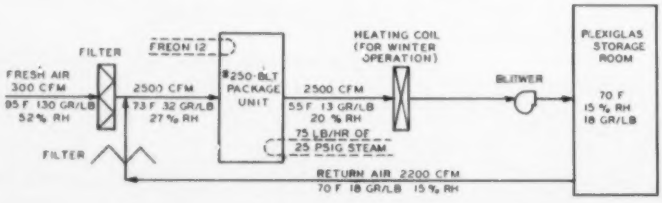
Automatic Operation

Control of the cooling coil temperature, then, controls both the humidity and temperature of the leaving air without the need for overcooling and reheating. These delivered air conditions of 55° F., 13 grains/lb. (20% r.h.) are adequate to maintain the storage space at 70° F., 18 grains/lb. (15% r.h.) when the temperature and humidity pick-up in the room are considered.

A small amount of fresh air, 300 c.f.m. at maximum conditions of 95° F. and 52% r.h. (130 grains/lb.) is introduced into the system to pressurize the space. However, since it is more economical from an operating cost viewpoint, the bulk of the air—2200 c.f.m.—is recirculated from the room.

This Kathabar system is entirely automatic, as the absorbent is continuously reconditioned for subsequent use. After completing the dehumidifying pass, a small amount of the solution is sprayed over low-pressure steam coils in a separate chamber of the unit. Here excess moisture in the solution is driven off and exhausted to the atmosphere by a scavenging air stream. A maximum quantity of 75 lb./hr. of 25 p.s.i.g. steam is used for this purpose. Total moisture removed from the air amounts to as much as 88 gal. of water per day under maximum operating conditions.

Flow diagram of air conditioning system for storage room. Air leaves dehumidifier at 55°F., 13 grains/lb., 20% R.H. to maintain 70°F., 18 grains/lb., 15% R.H. in the room



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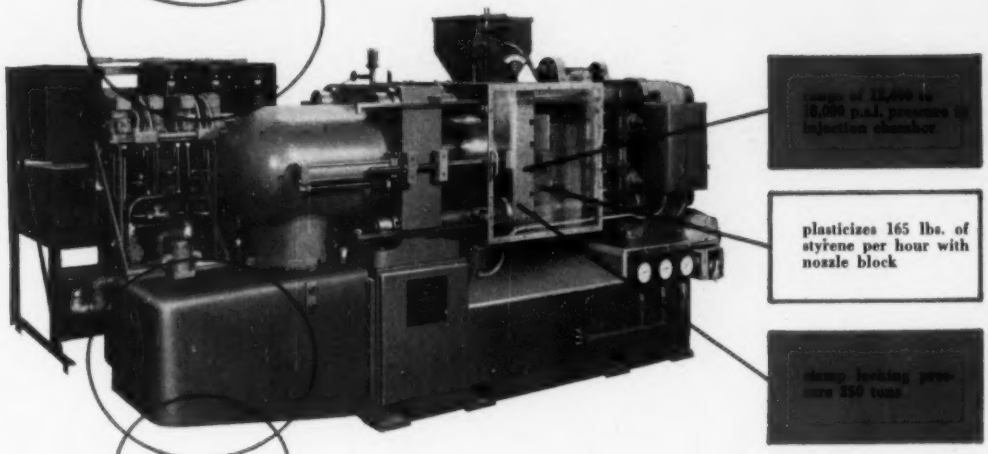
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Effects of Biaxial Stretch-Forming

by B. M. AXILROD†, M. A. SHERMAN†, V. COHEN†, and I. WOLOCK†

The effects of approximately 50% biaxial stretch-forming on the tensile and crazing properties of commercial cast polymethyl methacrylate sheets were investigated. Specimens from formed and unformed portions of the sheets were subjected to tests such as standard tensile, stress-solvent crazing with benzene, and long-time loading. The results indicate that biaxial stretch-forming to about 50% increased considerably the following properties: total elongation and the stress and strain at the onset of crazing in the standard tensile tests, the threshold of stress-crazing in the long-time tests (7 days), and the threshold of stress-solvent crazing with benzene. The considerable increase in the elongation at failure and in the stress-crazing and stress-solvent crazing threshold of polymethyl methacrylate as a result of moderate (50%) stretch-forming suggests that formed enclosures made from prestretched flat sheets may have greatly improved crazing resistance and strength properties, possibly to the extent that acrylic glazing need not be laminated.

ALTHOUGH polymethyl methacrylate glazing in aircraft is frequently prepared by a forming process which stretches the material, there is little information reported on the effect of this stretching on the tensile and crazing properties of the material. Some data of this type were obtained at Northrop Aircraft (1)[1]. Tensile tests were made on specimens taken from pieces of polymethyl methacrylate that had been stretched uniaxially. The pieces were stretched about 60% while at 265° F. and cooled while held at this elongation. It was found that at both room and sub-zero temperatures the specimens oriented transversely to the direction of stretch were appreciably weaker than the longitudinal specimens; also at room temperature the latter specimens showed appreciable permanent set in contrast to the former.

The effects of hot stretch-forming on polystyrene, a material somewhat similar to polymethyl methacrylate in forming behavior, have been reported by Bailey (2). It was found that uniaxial stretching of several hundred percent greatly increased the tensile strength, the elongation at failure, and the "crazing strength" in the direction of stretch; the tensile strength was greatly reduced perpendicular to the direction of stretch. Also the tensile strength of sheets hot-stretched first longitudinally and then transversely roughly 200% was reported as greatly increased for both directions.

The experiments that are described in this report were made to gain more information on the effect of forming on the crazing and other properties of polymethyl methacrylate. The properties determined on both formed and unformed pieces of sheet material included tensile strength, total elongation, strain and stress at the onset of stress-crazing, threshold stress for stress-solvent crazing, resistance to weathering.

The materials used were commercial cast polymethyl methacrylate sheets 0.12 to 0.15 in. in thickness. The samples used for all experiments were obtained directly from the manufacturers and were masked on one side only, as is done for sheets used to make laminated acrylic glazing. These samples, which included both general-purpose and heat-resistant grades, consisted of one sheet 36 by 48 by 0.15 in. from each of three production runs. They are referred to subsequently as "representative" samples and are identified as follows:

NBS *Sample*	*Material*	*Grade*
L1d	Lucite HC201	General-purpose
L2d	Lucite HC202	Heat-resistant
P1a	Plexiglas I-A	General-purpose
P2a	Plexiglas II	Heat-resistant

Apparatus and Procedures

Forming Process—A vacuum-forming apparatus which would produce flat biaxially-stretched disks about 10 in. in diameter was designed following suggestions offered by W. F. Bartoe, Rohm and Haas. A schematic diagram of the forming equipment is shown in Fig. 1. In this apparatus a sheet of acrylic material (A) heated to the rubbery state is clamped to the flange of the cylindrical forming vessel (B). A partial vacuum is created in the vessel by connecting the latter to an evacuated tank. The pressure differential is controlled by the plug valve (C), and the unclamped part of the sheet draws into the vessel. The form (D), an open-ended cylindrical tube a little smaller in diameter than the forming vessel and constrained by the guide (E), is inserted into the vessel. The pressure differential is then removed quickly by admitting air through the plug valve (F), so that the stretched acrylic sheet shrinks about the end of the form. The sheet cannot retract completely; the central portion remains uniformly stretched across the open end of the form. The

* Reg. U.S. Pat. Off.

† Organic Plastics Section, National Bureau of Standards.

[1] Numbers in parentheses refer to references beginning on page 184.

formed acrylic sheet, shaped like a top hat, is cooled to room temperature in the vessel before removal. In practice, the forming operation is done as quickly as possible so that the acrylic sheet will still be in the rubbery state when the pressure differential is removed; the time from removal of the sheet from the oven until forming is complete is less than 1 minute.

A few experiments were made to determine whether the amount of stretching is uniform over the face of the biaxially-stretched pieces. A grid was ruled on a few formed pieces and the grid spacings measured on stretching and relaxing the pieces. It was found that the amount of stretching was reasonably uniform over the face of the disk.

The formula used for calculating the amount of biaxial stretching in a formed disk is

$$e = 100\ (\sqrt{t_i/t_f} - 1),$$

where e is the elongation in percent and t_i and t_f are the initial and final thicknesses, respectively. This formula is based on the fact that the volume of the material remains essentially constant on stretching.

Exploratory tests showed that biaxial stretching of acrylic plastic sheet to approximately 50% strain had an appreciable effect on the crazing properties of the material.

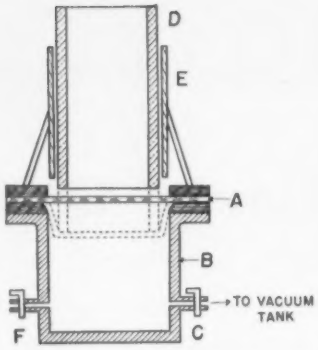

Fig. 1—Schematic drawing of vacuum-forming apparatus

Accordingly it was decided to form pieces from each sheet of the representative samples to an elongation of approximately this amount. One piece to be formed was heated in an oven to a temperature of 248° or 284° F., depending on whether the material was general-purpose or heat-resistant grade.

Standard Tensile Test — The tensile tests were made following Method 1011 of Federal Specification L-P-406a in most details. In these tests the threshold of stress-crazing was noted visually by an observer who immediately applied a sudden momentary pressure to the sensitive crosshead of the testing machine to cause a jog in the load-extension record drawn by the autographic recorder. The strain and the stress at this threshold could thus be readily obtained from the record. The observer viewed the crazing against a dark background using north daylight or fluorescent light.

Stress-Solvent Crazing — In the stress-solvent crazing tests, tapered tensile specimens of the same dimensions as the long-time tensile test specimens described in the text section were placed under load in a hydraulic testing machine, benzene applied, and the load maintained for 4 minutes. From preliminary trials on other specimens, the loads on these specimens were selected to produce crazing over a part of the tapered portion. The two specimens of each formed or control piece were tested with slightly different loads in an effort to locate the threshold at different parts of the tapered portion of the specimen.

Benzene was applied to the central ¼-by 3-in. portion of the specimen with a brush. Subsequently, the solvent-crazed specimens were examined under suitable lighting and the extent of the crazing noted.

Long-Time Tensile Test — The long-time tensile loading cabinet for testing at high (about 95%) relative humidity is shown in Fig. 2. A similar cabinet without a front cover or blower, and with an interior instead of exterior light was used for tests at 50% relative humidity, the condition in the controlled atmosphere room in which the cabinets were located.

The tensile specimen used for the long-time loading tests has a 3-in. long reduced section tapering uniformly in width from 0.50 in. at the maximum cross section to 0.33 in. at the minimum. In this way the stress in the reduced section decreases from a value of S_n at the minimum section to ⅔ S_n at the other end. The time for the onset of crazing for different stresses is found by observing the specimen periodically and noting the extent of the crazing. All the specimens were observed with the unaided eye; some were also observed with a 20-power Brinell microscope (Fig. 2). Observations of the extent and nature of crazing were made several times on the first day the load was applied, then generally daily through the

Fig. 2—Long-time tensile loading cabinet for testing at high relative humidity.

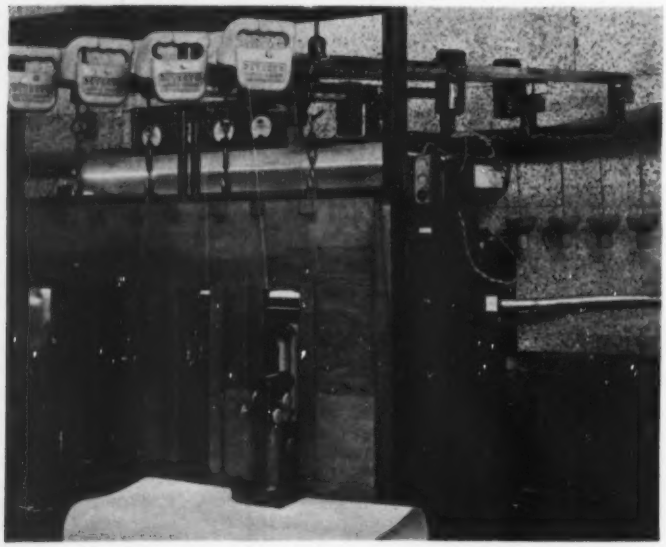

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Table I—Tensile Properties of Polymethyl Methacrylate Formed by Biaxial Stretching[a]

Material	NBS sample number	Biaxial stretch[b]	Tensile strength, S_m	Elongation	Secant modulus[f]	Stress and strain at threshold of crazing: Stress, S_c	$\frac{S_c}{S_m}$	Strain
		%	p.s.i.	%	10^4 p.s.i.	p.s.i.		%
UNFORMED								
Lucite HC201	L1d	—	7850± 80	8.8±1.2[c]	3.63±.05	6780±140	.86	2.4±0.15
Lucite HC202	L2d	—	9580±100	14 ±3	4.00±.03	8380±180	.88	2.9±0.3
Plexiglas I-A	P1a	—	7920± 50	19 ±7	3.75±.01	7170±100	.91	2.6±0.1
Plexiglas II	P2a	—	10070±170	7.6±0.4[d]	4.06±.09	9080±180	.90	3.2±0.1
FORMED								
Lucite HC201	L1d	54	7830±130	73 ±3[e]	3.60±.05	Very light crazing; two specimens crazed at 4 and 6.5%, resp., others at hand marks at >10% strain.		
Lucite HC202	L2d	57	9650±140	59 ±4	4.01±.05	Three specimens did not craze. Very light crazing on two specimens at ~ 7%, on one at >10% strain.		
Plexiglas I-A	P1a	59	8030± 90	67 ±4	3.73±.05	Four specimens did not craze. Possible very faint crazing on two specimens.		
Plexiglas II	P2a	50	9930± 80	49 ±3	4.04±.01	Three specimens did not craze. Very light crazing on others at hand marks at >10% strain.		

[a] The tests were made on standard tensile specimens, Federal Specification L-P-406a, Method 1011, Type I. The testing machine used was a 2400-lb. capacity hydraulic universal testing machine. Autographic load-elongation records were obtained with a nonaveraging Southwark-Peters extensometer, Model PS-6, coupled to the associated recorder on the testing machine. The testing speed was 0.05 in./min. up to 10% strain; the strain gage was removed at this point and the speed increased to 0.25 in./min. with further extension measured with dividers. The testing was done at 23° C. and 50% relative humidity after conditioning the specimens for 2 weeks in this atmosphere. All results are the average for six specimens, two specimens from each sheet, unless otherwise noted, plus or minus the standard error. The standard error was calculated taking into account the possible existence of sheet-to-sheet variations.

[b] Average for three disks.

[c] One specimen failed at knife edge, at 5.1% elongation.

[d] Two specimens failed at knife edges, at 4.4 and 9% elongation, respectively.

[e] Two specimens failed at knife edge marks, each at 77% elongation.

[f] The stress range used for the calculation of the secant modulus was 0 to 4000 p.s.i. for the Lucite HC201 and Plexiglas I-A and 0 to 5000 p.s.i. for the Lucite HC202 and Plexiglas II.

fifth day, and once on the eighth day, after which the load was removed. The extent of the crazing from the minimum cross section was measured with a paper scale to the nearest millimeter; this corresponds to an accuracy of better than 1% when converted to stress. The observed data on the extent of the crazing were converted into stress values and the latter were plotted against log time.

Accelerated Weathering—The accelerated weathering test employed was the sunlamp-fog chamber type. This test was made in accordance with Method 6021, Federal Specification L-P-406a, except that it was carried out for 480 hr. Light transmission and haze measurements were taken before and after the weathering test using a Gardner pivotable-sphere hazemeter, following the procedure in A.S.T.M. Method D 1003-49T. To permit the measurement of shrinkage, scratches were ruled on each specimen about 2 in. apart before the weathering. The scratches were measured with a steel rule graduated to 0.01 inch. In measuring the distance between scratches a 7-power magnifier was used, the distance being estimated to 0.001 inch.

Standard Tensile Tests

The results of the standard tensile tests on the formed and the unformed portions of the four representative samples are shown in Table 1. Figure 3 illustrates the appearance of the fractures on broken specimens of formed and unformed material. The tensile strength and secant modulus of elasticity of the four samples of polymethyl methacrylate were unaffected by stretch-forming to about 50% elongation. The elongation at failure, as in the exploratory tests, was greatly increased by forming, from approximately 10% to about 60%. The strain at the threshold of crazing also was increased greatly as a result of the forming. In fact, for examples L2d, P1a, and P2a, at least half of the specimens showed no stress-crazing up to rupture. Crazing on other specimens was very light or was observed only at accidental finger marks.

It is of interest to consider the fracture behavior and the fracture mechanism in the formed and unformed material. While the specimens of the unformed material commonly failed at 5 to 10% elongation with the fracture approximately flat and normal to the tensile load line, as shown by A in Fig. 3, occasionally a specimen exhibited a much greater elongation, sometimes accompanied by an oblique fracture (B in Fig. 3). It was also observed that the formed specimens as shown in Fig. 3 (C, D, E, F) had a laminar fracture. The laminar fracture of formed material indicates that the segments of the polymer molecules have a preferred orientation in the plane of the sheet thus favoring fracture propagation on planes nearly parallel to the plane of the sheet. In the unformed material the segments of the polymer molecule are assumed to be randomly oriented.

Although it is not readily seen from Fig. 3, on the fracture surface of each specimen there was a small mirror-like area oriented perpendicularly to the tensile lead line. On specimens of unformed material the mirror area was diffusely bounded; on the formed the boundary was sharp. The mirror-like surface was of the order of a few square millimeters in area and was found extending inward from the boundary of a cross section. From an examination of these specimens and from other experimental evidence, discussed in detail in reference 3, it is logical to conclude that fracture begins in the mirror area at the surface of the material, and also that in unformed material the mirror area is an extension of a crazing crack.

Stress-Solvent Crazing

The threshold stress data for the stress-solvent crazing tests on the 50% biaxially-stretched disks are shown in Table II. Typical specimens are shown in Fig. 4. The threshold was determined visually using two criteria. For the first, called criterion A, the threshold was taken as the maximum stress below which there was no regular distribution of crazing cracks visible to the unaided eye, the isolated cracks being dis-

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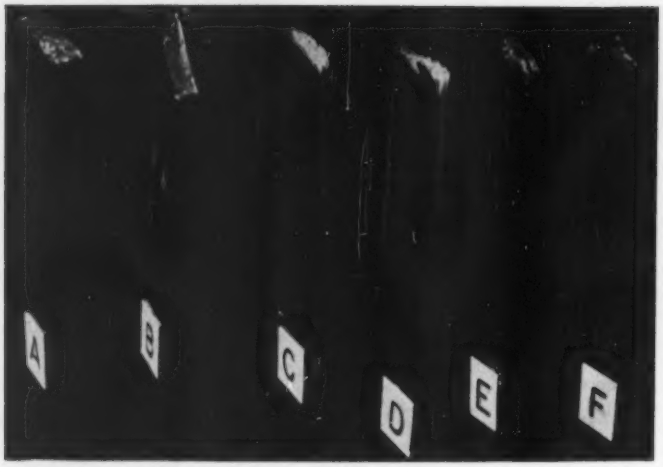

Fig. 3—Effect of biaxial stretch-forming on fracture of tensile specimens.

Fig. 4—Specimens of formed and of unformed portions of sample P2a after stress-solvent crazing with benzene. Code: The number on the top line designates the sheet from which the specimen was taken. U is unformed and F is formed material. S_o is the stress in p.s.i. at the minimum cross-section of the specimen. S_{oc} is the threshold stress according to criterion B.

regarded. For the second, criterion B, the threshold stress was taken as the maximum stress below which no crazing cracks were visible to the unaided eye.

As might be expected, the average threshold crazing stress obtained by criterion B is slightly less than by criterion A. However, the principal results as obtained by the two methods are in agreement. The average threshold crazing stress for general-purpose polymethyl methacrylate, crazed with benzene by the procedure described previously, is about 2000 p.s.i. for unformed and about 3400 to 3800 p.s.i. for the 50% biaxially-stretched sheets. The corresponding values for the heat-resistant grade are about 3000 p.s.i. and 5000 to 6000 p.s.i., respectively. This represents an improvement of from 70 to 80% for each grade. Not only did the formed specimens exhibit higher threshold stresses than the unformed, but also there was a tendency for the crazing cracks to be somewhat finer and more closely spaced on the formed specimens.

Table II—Threshold Crazing Stresses for Stress-Solvent Crazed Specimens of Polymethyl Methacrylate Formed by Biaxial Stretching[a]

NBS sample number	*Material*	*Biaxial stretch[b]*	*Threshold crazing stress[c], S_{oc} Criterion A[d]*	*Criterion B[d]*	*Range of S_o, the maximum stress applied, for the set of specimens*
	UNFORMED	%	*p.s.i.*	*p.s.i.*	*p.s.i.*
L1d	Lucite HC201	—	2110± 40	2000± 50	2700 – 3000
L2d	Lucite HC202	—	3020± 40[e]	2820±190[e]	3000 – 3600
P1a	Plexiglas I-A	—	2300±150	2120±120	2400 – 3000
P2a	Plexiglas II	—	3270±140	3120±160	3900 – 4500
	FORMED				
L1d	Lucite HC201	54	3390±150[f]	3310±130[f]	3000 – 4500
L2d	Lucite HC202	57	5550±280[e]	5130±380[e]	5600 – 6900
P1a	Plexiglas I-A	59	3890±310	3690±310	4200 – 5400
P2a	Plexiglas II	50	5720± 90[e]	5590±110[e]	6000 – 7200

[a] A controlled amount of benzene, 0.03 to 0.04 g., was applied to a No. 1 camel's hair brush (about 0.1 in. in diameter and 0.5 in. long) from a marked glass dropper; then the central ¼- by 3-in. portion of one face of the tapered tensile specimen, which was under load, was stroked with the brush. The specimens were under load for 4 min. and then were removed from the testing machine; after 4 to 6 days they were examined for crazing thresholds. The crazing was done in a controlled atmosphere room operating at a temperature of 23° C. and 50% relative humidity after conditioning the specimens for 1 week in that atmosphere.

[b] Average for 3 formed disks, 1 from each sheet of the sample.

[c] Each value is the average plus or minus the standard error for 6 specimens with 2 specimens from each sheet. The standard error was calculated taking into account the possible existence of sheet-to-sheet variation.

[d] Criterion A: That point below which there is no regular distribution of crazing cracks visible with the unaided eye; isolated cracks are disregarded.
Criterion B: That point below which no crazing cracks were visible to the unaided eye.

[e] One specimen did not craze under the load applied.

[f] Two specimens did not craze under the loads applied.

Long-Time Tensile Tests

The plots of threshold crazing stress versus log time were in general approximately linear. For most specimens the extent of crazing was recorded separately for each face of the specimen because the crazing often progressed more rapidly on one face than on the other. An examination of the plotted data showed no consistent behavior of the masked relative to the unmasked face (see also reference 4). Any consistent difference in the extent of crazing on the two faces was accordingly assumed to be caused by a slight misalignment of the specimen.

The slopes of the threshold stress versus log time plots appeared to be about the same for all materials and test conditions. The effect on the threshold stress of factors such as forming, relative humidity, sample, and grade is indicated best by examining the 100-hr. unaided-eye values, as these are the most numerous and precise. These values together with values of the ratio of the threshold stresses for the formed and unformed specimens of each sample are listed in Table III. The data indicate that forming to

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Table III—Threshold Crazing Stresses of Acrylic Plastics After 100 Hours Under Tensile Load At 23° C.[a]

NBS sample number	S_c at 50% relative humidity[b] Formed (F)	Unformed (U)	$(S_c)_F / (S_c)_U$	S_c at 95% relative humidity[b] Formed (F)	Unformed (U)	$(S_c)_F / (S_c)_U$
	p.s.i.	p.s.i.		p.s.i.	p.s.i.	
L1d	3750	2450	1.53	3350	<2500	>1.34
P1a	>4000	3050	>1.31	>4000	2850	>1.40
L2d	5500	3300	1.67	5000[c]	3400	1.47
P2a	5750	4000	1.44	5650	4150	1.36

[a] Specimens were conditioned at the test humidity for at least 2 wk. for tests at 50% and for 1 wk. for tests at 95% relative humidity. The standard error of the values shown in this table is of the order of 200 p.s.i. based on the agreement between duplicates.
[b] Average for two specimens.
[c] Value for one specimen only.

a biaxial strain of about 50% increases the threshold crazing stress of all samples about 40 to 50%. The data are not precise enough to determine with certainty any difference in threshold crazing stress due to relative humidity or to material of a given grade.

The appearance of the long-time tensile loading specimens is illustrated by Fig. 5 taken near the end of the testing period. The threshold crazing stress values give an incomplete picture of the effect of forming and other variables on the crazing behavior of the materials. The crazing on the formed specimens, where it occurs, is usually finer than that on the unformed specimens. Also, although in general the threshold stresses at the two relative humidities did not differ appreciably, the cracks at 95% relative humidity appeared finer and more closely spaced and were almost always noticeably shorter than those at the lower relative humidity.

For most specimens the lengths of the longest cracks in the vicinity of the minimum section were measured with the Brinell microscope. The data indicate that the crazing cracks tend to grow more slowly on formed as compared to unformed specimens.

Mechanism of Crazing

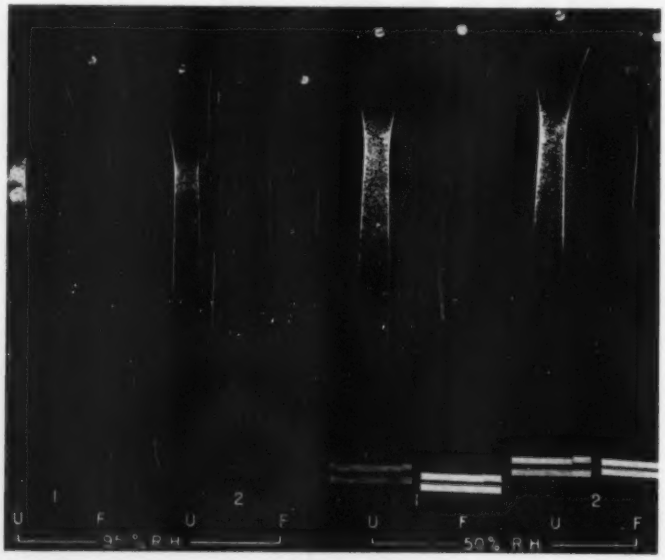
The effects of biaxial stretch-forming on the crazing behavior of polymethyl methacrylate perhaps may be explained qualitatively on a molecular basis as follows: In the unformed state the polymer molecules are assumed coiled in an approximately spherical shape; the chain segments have no preferred orientation. In the formed state the molecules should be somewhat uncoiled and in a roughly disk-like shape with the chain segments oriented predominantly in the plane of the material. The following mechanism of crazing, somewhat similar to that proposed by Maxwell and Rahm (5), is postulated. The crazing is assumed to start at the surface at submicroscopic flaws or weak points. Such weak points may be submicroscopic regions in which by chance the polymer chain segments are oriented normal to the applied tensile stress. With sufficient stress a separation between portions of adjacent chains occurs; a stress concentration exists at the apex of the crack and the latter grows until it reaches a region in which the polymer chain segments are oriented approximately in the direction of the tensile stress. The crack either does not grow or grows slowly unless the tensile stress is greatly increased. Subsequent crack growth may involve rupture of primary valence bonds especially if the stress is relatively high, of the order of the tensile strength.

The process of biaxial stretch-forming, by orienting the chain segments in the plane of the sheet, reduces the proportion and size of the weak normally oriented regions and increases the regions of predominantly parallel orientation. Stated differently the stretch-forming may be said to introduce "cleavage" planes in the plane of the sheet. This orientation or introduction of cleavage planes greatly impedes the development and growth of crazing cracks. Thus, as noted previously in the long-time tensile loading tests, the crazing cracks, after becoming visible, grew more slowly on formed as compared to the corresponding unformed specimens.

In regard to stress-solvent crazing, mechanisms have been suggested by various authors (6, 7, 8) which while differing in some aspects include as a factor the concept of the solvent acting as a plasticizer. By using this

(Continued on p. 182)

Fig. 5—Specimens from sample P2a, formed and unformed, after 7 days of loading with 6000 and 5000 p.s.i. stress at the minimum sections of the formed and unformed specimens, respectively.



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Fluorothene Wire Insulation

by B. H. MADDOCK* and W. M. LAND*

A class of thermoplastic high polymers known as monochlorotrifluoroethylene or Fluorothene has proved of considerable interest in many wire coating applications, particularly for operation at temperatures up to about 300° F. and where resistance to corrosive chemicals or high insulation resistance over a wide temperature range is important. This paper discusses the manner in which certain inherent characteristics of these polymers contribute to the service properties of insulated wires and offers suggestions for extrusion techniques that will produce optimum results.

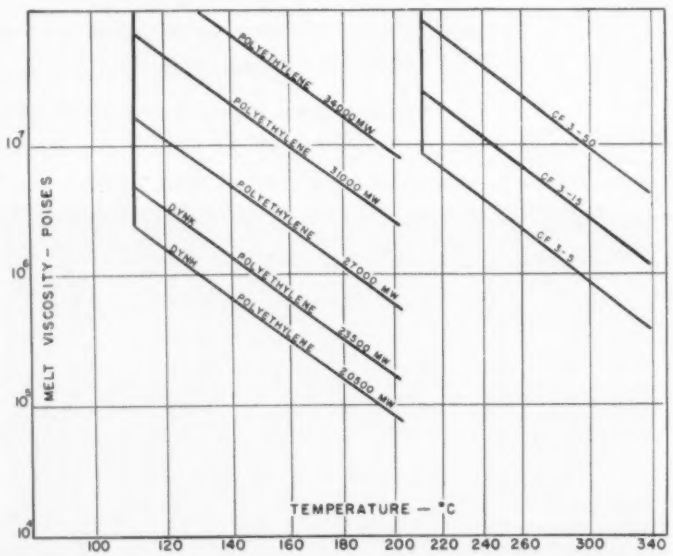
FLUOROTHENE polymers, having the general chemical structure $(CF_2CFCL)_n$, can be produced in a range of molecular weights from colorless low viscosity liquids, through greases and waxes, to hard transparent resins having a softening point of approximately 208° C. The higher molecular weight materials are of interest for wire insulation; the liquid polymers are used in some instances as plasticizers or extrusion aids for the resinous materials.

The high molecular weight resins are graded either by melt viscosity at 230° C., as determined on a parallel plate plastometer, or by No Strength Temperature, which is the point at which a notched specimen pulls apart under a small load at a fixed rate of temperature rise. The former system is used by the Bakelite Co. which supplies three grades designated as Fluorothene CF3-5, CF3-15, and CF3-50; the figure following the dash indicates the melt viscosity in megapoises at 230° C. These values correspond to No Strength Temperatures of approximately 230°, 257°, and 286° C., respectively.

Properties

Fluorothene is similar to polyethylene in many of its properties except that the corresponding regions of temperature response are moved approximately 100 degrees C. higher. It melts at about 208° C. similar to the melting of polyethylene at about 110° C. At temperatures above the melting point the viscosity decreases gradually in both materials at a rate equivalent to an activation energy of approximately 15,000 cal. per mol. This is illustrated in Fig. 1 where melt viscosity is plotted against temperature for three standard grades of Fluorothene and several polyethylene resins. Polyethylene resin DYNH (D-55) is the grade most widely used in industry; the other polyethylene resins shown in Fig. 1 are experimental higher molecular weight materials. It should be noted that the viscosities of the Fluorothene resins are very high in the working temperature range of 230° to 300° C. and have approximately the same viscosities as the higher molecular weight polyethylene at temperatures of from 130° to 200° C.

Fig. 1—Melt viscosity of polyethylenes and fluorothenes at various temperatures



Mechanically, Fluorothene behaves like a rigid thermoplastic in many

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respects and should be classified as such, although in thin sections it does exhibit a certain degree of flexibility. It has a fairly high tensile strength of 5000 p.s.i. at room temperature, but the extent to which it can be strained (elongated) without permanent deformation is low, on the order of 5 to 8 percent. If strained beyond this level it necks down and orients before breaking similar to, but to a lesser degree than, polyethylene. It must be recognized, therefore, that for applications where flexibility is required, such as wire insulation, the magnitude of strain must be kept to a relatively low value and that the degree of flexibility associated with rubber or plasticized vinyl insulating materials cannot be expected with Fluorothene. Load-elongation curves for Fluorothene compared with other rigid and elastomeric materials are shown in Fig. 2.

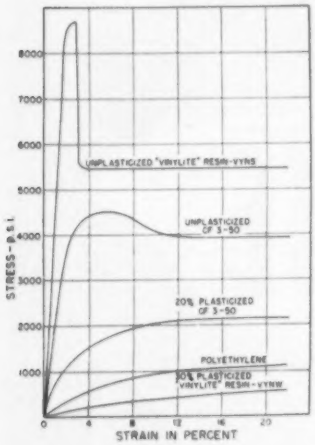

Fig. 2—Load-elongation curves for various plastics

Elasticity vs. Temperature

The stiffness or modulus of elasticity of Fluorothene decreases very gradually over a wide temperature range, from a value on the order of 500,000 p.s.i. at −100° C. to about 6000 to 8000 p.s.i. at a temperature slightly below its softening point, as shown in Fig. 3. Fluorothene thus has a stiffness considerably above the level of 200 to 1500 p.s.i. at which a material is normally considered to have elastomeric properties. Elastomers and most rigid thermoplastics ordinarily exhibit a rapid decrease in stiffness over a comparatively narrow temperature range. Above this range they reveal low stiffness values and a high degree of flexibility. At temperatures below this range they become extremely brittle and shatter readily. The position of this region on the temperature scale determines the usefulness of such a material. For the natural and synthetic rubbers it is generally at a low temperature (−40° to −70° C.). For the rigid thermoplastics it is usually at an elevated temperature (60° to 100° C.). By plasticization it is shifted down the temperature scale so that a rigid material often can be made to take on elastomeric properties by suitable choice of plasticizers, usually at the expense of high temperature properties. Similarly, plasticizing Fluorothene resin with low molecular weight Fluorothene polymers promotes some increase in flexibility in the room and elevated temperature range at a sacrifice of about 1 degree C. in softening temperature for each 1% of plasticizer added. Also, the plasticizer tends to crystallize at low temperatures and become ineffective. To date no distinct advantage of plasticized Fluorothene resins has been determined for wire coating applications and most users have confined their investigations to the unplasticized resins.

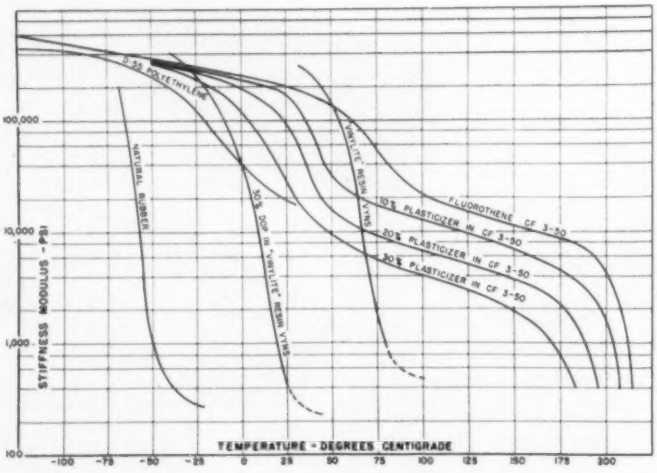

Fig. 3—Stiffness modulus versus temperature for various materials

Crystallinity

Fluorothene may be considered a mixture of crystalline and amorphous material, and both the degree of crystallinity and the size of crystal aggregates depend upon its thermal history. If cooled rapidly to room temperature from above the transition temperature of 208° C. (406° F.) it is highly transparent in thin sections, suggesting a highly amorphous structure, and, in this state, exhibits maximum flexibility, toughness, and impact resistance. Actually, considerable crystallinity exists in the quenched state, the crystals being of such minute size that they do not cause scattering of the incident light. If cooled slowly through the region immediately below the transition temperature it becomes translucent, indicating a higher degree of crystallinity and the formation of large crystallite aggregates, or spherulites. In this state it is inclined to be stronger, harder, and more brittle than a rapidly cooled specimen. Thus it is usually desirable to quench wire insulation during the coating operation. Complete transparency cannot be obtained in thicknesses greater than about 0.100 in., however, due to the

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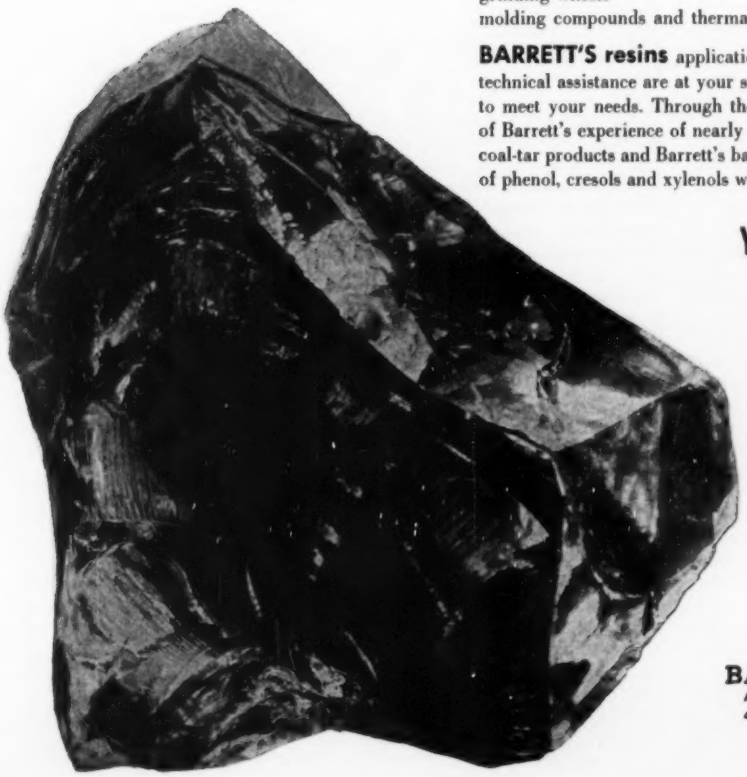

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low thermal conductivity of Fluorothene, and the center layers of heavier sections are likely to be more crystalline than the surface layers.

Crystallite growth and aggregation occurs in quenched samples when held for prolonged periods at elevated temperatures, such as 150° to 200° C. (302° to 392° F.). This determines the maximum service temperature, since the principal result of the increased crystallinity is embrittlement, leading eventually to crack failures or voltage breakdown if the wire is flexed after heat aging. Both the minimum temperature at which crystallization takes place and the rate of crystallization are functions of the molecular weight; the lower the molecular weight or melt viscosity of the fabricated product, the lower the temperature and the more rapid the rate at which embrittlement occurs.

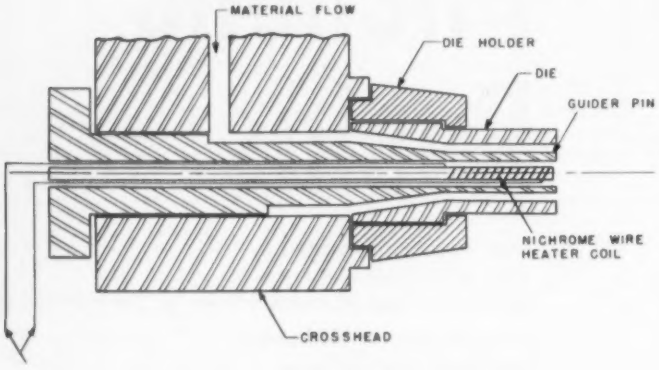


Fig. 4—Diagram of extruder shows design of guider pin

Heat Stability

Fluorothene has been shown to be heat stable for short periods of time up to about 280° C. (536° F.), but it begins to decrease in viscosity or depolymerize at a rapidly increasing rate at temperatures above that value. Resin temperatures in the range of 300° to 325° C. (572° to 626° F.), depending upon the original viscosity and certain extruder design and operating variables, are normally required for wire insulation with a conventional cross-head type screw extruder. Extensive viscosity degradation takes place, therefore, during extrusion and it is generally found that the melt viscosity at 230° C. (446° F.) of the extruded product is in the range of 1 to 3 megapoises, regardless of the initial viscosity of the resin used. A viscosity level of 2 to 3 megapoises appears to be about the minimum for satisfactory aging of Fluorothene insulated wires at service temperatures of 135° to 150° C. (275° to 302° F.), and it is obviously desirable to keep the final viscosity at as high a level as possible. There is reason to believe that if a viscosity of 25 to 50 megapoises could be maintained, a service temperature considerably higher than the present limit would be possible. There is also reason to believe that this idealized result can be approached by modifications in extruder design and operating techniques and by further improvements in resin stability.

Extrusion Equipment

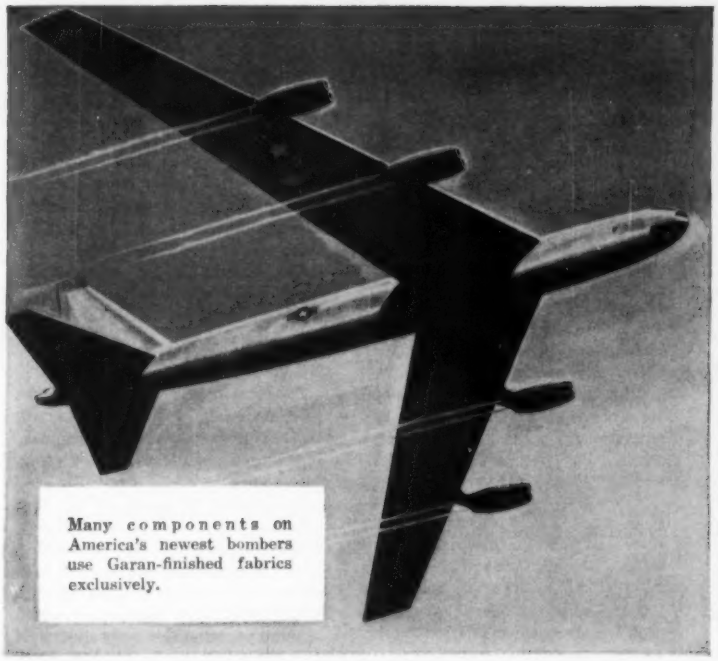
Fluorothene can be extruded in conventional plastic extrusion equipment capable of attaining the necessary temperatures, in many cases without or with only minor modifications. Many types of extruders have been used successfully for extrusion of Fluorothene onto wire. Operating conditions may vary rather widely, depending on the extruder design; the primary considerations are always the prevention of excessive temperature development in the resin, either by conduction or by frictional heating, and the ability to control all machine temperatures within narrow limits. Electrical heating of the cylinder, head, and dies is most prevalent because of the relative ease of obtaining temperatures in the range of 500° to 650° F., but it is often necessary to provide some auxiliary means of cooling to remove excess frictional heat, particularly in the front cylinder section. Steam cooling has proved satisfactory in the authors' experience. Several extruders of recent design in which cooling is accomplished by means of air blowers, water sprays, or liquid cooling jackets are claimed to provide excellent heat balance and close temperature control. Machines heated by a circulating hot liquid probably provide more positive and uniform temperature control, but are slower in response to changes in temperature setting. Special heat transfer oils suitable for use at the desired temperatures are now available and it is felt that advantage of these materials could be taken in the design of extrusion equipment ideally suited for use with Fluorothene resins.

No optimum design for the screw has yet been determined. In general, full flight screws of low compression ratio (1.5:1.0), either single or double thread, have given satisfactory results. A "metering" type screw with a compression ratio of 2.5:1.0, such as is normally used in the extrusion of nylon, has also given good results. In some cases the screw has been operated without cooling or temperature control. This often gives rise to severe surging or pulsation in the output rate, particularly at low screw speeds. This condition can usually be eliminated by circulating a liquid through the screw at a controlled temperature in the range of 300° to 350° F. At screw temperatures below 300° F. the extrusion rate may be seriously decreased and at temperatures above 350° F. some difficulty with premature fluxing of small resin particles on the feed thread of the screw has been experienced, resulting in obstruction of the flow of granular material from the hopper. Steam has not proved entirely satisfactory as a screw cooling medium.

Extruder Operation

Experience has shown the need for careful consideration of each step in

(Continued on p. 186)



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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

ASTM STANDARDS—THEIR EFFECT ON PLASTICS TECHNOLOGY. R. Burns. ASTM Bulletin No. 183, 78-80 (July 1952). The effect of ASTM standards on the plastics industry and how these standards are created are described.

VERSATILE FLUORINE PLASTICS. Chem. Eng. News *30*, 2688-91 (June 30, 1952). Properties and applications of the fluorocarbon plastics are reviewed briefly.

THE PLACE OF PLASTICS IN THE ORDER OF MATTER. J. J. P. Staudinger. Brit. Plastics *25*, 160-4 (May 1952). Relations between the chemical structure and physical characteristics of organic polymers are described. The relations between plastics and metals are also considered. The place of plastics in the order of matter is now firmly established as the essential link between the natural organic materials such as pitch, shellac, rosin, rubber, wax, horn, and wood on the one side, and the minerals (glass, clay, stone) and metals on the other side. The organic matters, with the exception of horn and wood, have thermal and mechanical characteristics too low to be useful for structural designs, whereas horn and wood, still light in weight and possessing already good mechanical properties, do not lend themselves to such wide variety of applications as plastics do. It is here that plastics ensure the continuity of performance characteristics between the natural organic matters and the minerals and metals. By virtue of their position in the order of matter, plastics frequently combine some of the good features of either group and for this reason the application of plastics will not only cover those fields where previously other materials have been misapplied for lack of any better material, but will also greatly expand on their own account, as, for example, in the increasingly important fields of electronics, television, and radar. Here, the developments on an industrial scale would not be possible without the aid of plastics. Plastics, which have only begun to show their mettle, will become one of the major materials of construction in our age, which becomes more and more dependent on manufactured materials and fabricated goods.

* Reg. U.S. Pat. Office

Materials

A NEW FORM OF MICA INSULATION. H. A. Letteron. Electrical Manuf. *49*, 142-3, 336, 338, 340, 342 (June 1952). The properties of mica tapes used for electrical insulation are reported. These tapes are made by bonding mica with asphalt, silicone resins, alkyd resins, vinyl resins, and shellac.

SELECTING SPECIAL-PROPERTY ORGANIC FINISHES. A. L. Alexander. Electrical Manuf. *50*, 106-9, 296, 298, 300, 302 (Aug. 1952). Coatings based on polyethylene, fluorocarbons, epoxy, silicone, and silicone-alkyd resins are described.

EXTRUSION PROPERTIES OF LUBRICATED RESIN FROM COAGULATED DISPERSION. J. F. Lontz, J. A. Jaffe, L. E. Robb, and W. B. Happoldt, Jr. Ind. Eng. Chem. *44*, 1805-10 (Aug. 1952). Various alcohols, esters, hydrocarbons, chlorinated hydrocarbons, and the silicones were found effective as lubricants in the extrusion of coagulated teflon polymer. The lubricated mixtures are prepared by three general methods, two of which are based on the formation of coagulated polymer granules and subsequent admixture with organic compounds. The third method involves a transfer coagulation, whereby the lubricant is added to the aqueous dispersion and the intimate mixture is coagulated by the addition of certain organic solvents or salts simultaneously with mechanical agitation. After extrusion below the transition temperature at 327° C., the lubricant is removed from the extruded article either by solvent extraction or by volatilization. The lubricant-free extrudate is then fused above the temperature at 327° C. to produce fabricated articles possessing excellent electrical insulating and physical properties. The lubricated compositions are suitable for extrusion into such useful products as monofilaments, wire insulation, tapes or films, rods, and tubing. The new dispersion of the polymer extends the outstanding properties of this resin to a number of applications other than extrusion and molding, to which it has hitherto been limited.

PREPARATION OF CATION EXCHANGE RESINS OF HIGH PHYSICAL STABILITY. R. M. Wheaton and D. F. Harrington. Ind. Eng. Chem. *44*, 1796-1800 (Aug. 1952). A superior ion exchange bead particle may be prepared by first swelling the styrene-divinylbenzene copolymer in a polystyrene solvent, which is essentially nonreactive with sulfuric acid, before proceeding with actual sulfonation to make a cation exchange resin. Careful dilution of the sulfonated product is important, as are drying and rewetting of the diluted product, to maintain good physical strength.

POLYVINYL ACETATE EMULSIONS. A. E. Lever. Plastics (London) *17*, 199 (July 1952). The manufacture, formulation, properties and uses of polyvinyl acetate emulsions are described.

Properties

EFFECT OF ORIENTATION ON THE MECHANICAL PROPERTIES OF POLYSTYRENE. R. G. Cheatham and A. G. H. Dietz. Trans. ASME *74*, 31-40 (Jan. 1952). Extruded polystyrene rod was first annealed, and then stretched hot to elongations as high as 12,000 percent. Tests were made in tension, flexure, and torsion at temperatures ranging from 0 to 80° C. Tests included creep and relaxation as well as tests at strain and load rates ranging as high as 1.0 in./in./min. and 10,000 lb./min. to determine the effect of orientation upon these mechanical properties. Tensile and flexural strengths increased two to threefold, depending upon rate and temperature; torsional strength decreased; and modulus of elasticity increased moderately. Fracture changed from a sharp break to a fibrous separation. Birefringence measurements revealed marked ori-

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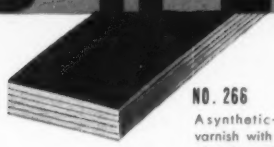

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entation of the material, but low-angle x-ray diffraction studies revealed no "crystalline" structure.

EFFECT OF VELOCITY ON TENSILE IMPACT PROPERTIES OF POLYMETHYL METHACRYLATE. B. Maxwell and J. P. Harrington. Trans. ASME *74*, 579-87 (May 1952). The history of impact testing of plastics is reviewed and the current theories of impact resistance are discussed. The effect of velocity on the energy absorbed by polymethyl methacrylate at various temperatures was studied with the aid of two new testing machines. The results are interpreted in terms of the classical theories of mechanics of materials and the current theories of the rheology of high polymers. It is concluded that there are two distinct critical velocities of straining in this material—the lower one corresponding to the relaxation of the bonds restraining chain-chain slipping and the higher one corresponding to the relaxation of the secondary bonds involved in chain uncoiling. Both of these relaxations are temperature dependent, the lower one to a slight extent and the upper one to a marked extent. Above the two critical velocities the response of the material is purely elastic. A method of calculating the energy to break at rates of straining above the second critical velocity from the slow-rate stress-strain curves is demonstrated.

EFFECT OF ABSORBED WATER ON PHYSICAL PROPERTIES OF PHENOLIC PLASTICS. H. M. Quackenbos, Jr. and J. M. Hill. Trans. ASME *74*, 41-50 (Jan. 1952). The absorption of water by phenolic plastics obeys Fick's law and can be described completely by a saturation constant, a diffusion constant, and a simple relation between diffusion constant and temperature. Two important consequences of water absorption are that mechanical properties change and all dimensions expand, the magnitude of each seeming to remain roughly constant for each percent of water absorbed. In practice, expansion may give rise to undue warping and high stresses (or even failure) and is directly connected with dimensional stability. It is shown how these effects may be analyzed rationally by using the coefficient of expansion and the constants describing absorption.

AN IMPROVED WATER EXTRACTION TEST FOR POLYVINYL CHLORIDE ELASTOMERS. E. F. Schulz. ASTM Bulletin

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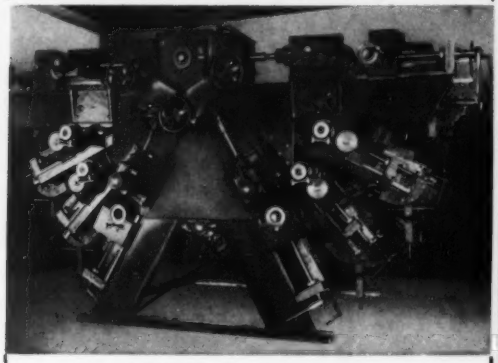

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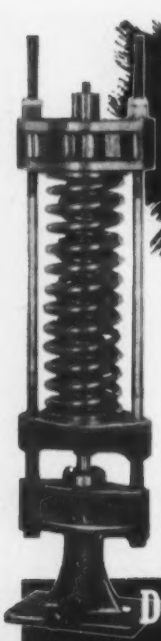

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No. 183, 75-8 (July 1952). An improved water extraction test for plasticized vinyl sheeting is described. The method is unique in that activated carbon is employed to overcome the low plasticizer solubility in a limited volume of the extractant. In the development of the method it was found that water extraction is not increased by mere agitation of the water. However, when the water is continually refreshed at a high rate of exchange, the increase is pronounced. The presence of activated carbon in the water greatly increases the extraction. Static water extraction in activated carbon is approximately equal to extraction by continuous water exchange. Thus, saturation of the water with plasticizer can be avoided with activated carbon or by a continuous water exchange system. Of these, the use of activated carbon is the more feasible. The water extraction in percent is shown to decrease markedly with increased specimen thickness, increase exponentially with rising test temperature, increase with increased plasticizer content, and differ greatly between various plasticizer systems. A definite correlation is evident between extraction tests by an existing method and the activated carbon technique. The precision of the activated carbon procedure is estimated at ±14% with 95% certainty.

Effect Of Temperatures From −70° to 600° F. On Strength Of Adhesive-Bonded Lap-Shear Specimens Of Clad 24S-T3 Aluminum Alloy And Of Cotton- And Glass-Fabric Plastic Laminates. H. W. Eickner, W. Z. Olson, and R. F. Blomquist. National Advisory Committee for Aeronautics Technical Note 2717, 26 pp. (June 1952). The performance of 14 commercial adhesives at temperatures from −70° to 600° F. was evaluated in lap-shear specimens of clad 24S-T3 aluminum alloy to itself and that of 7 commercial adhesives at −70° to 250° F. in lap joints of cotton-fabric-phenolic laminate to itself, of glass-fabric-polyester laminate to itself, and in joints of each of these laminates to clad aluminum. One hot-setting tape adhesive was found to be significantly superior to all others in lap-joint specimens of aluminum alloy to itself. All commercial adhesives evaluated at −70° to 250° F. in lap-shear specimens of plastic laminates bonded to them-

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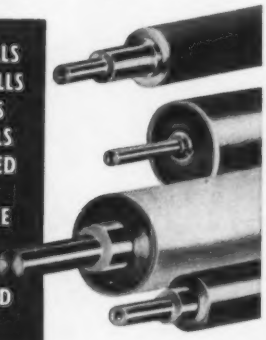

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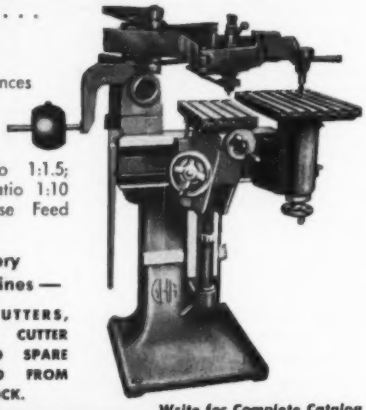

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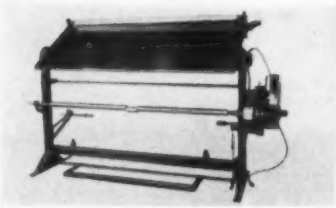

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selves and to aluminum had only fair resistance to stressing immediately upon reaching 250° F. The adhesives generally performed adequately in the various joints at −70° F.

MEASUREMENT OF RESIDUAL STRESS IN THERMOSETTING PLASTICS. R. DeWaard, C. R. Stock, and T. Alfrey, Jr. ASTM Bulletin No. 181, 53-9 (Apr. 1952). A method is presented for determining the distribution of residual stresses through the thickness of molded thermosetting plastics. Stress analysis is based upon the bending produced by milling into one surface of narrow strips. Filled urea and phenolic moldings are left in a state of internal stress by compression molding procedures, and both heat and moisture during post-molding environment tend to accentuate this condition. Since surface stress in all cases was found to be compressive, it is argued that residual stress in these materials is beneficial from the standpoint of strength in flexure. Other service implications of residual stress are also presented.

Molding and Fabricating

ELECTRIC CONTROL OF AIR-FLOW POROSITY IN PLASTIC SHEET MATERIALS. J. J. Suran. Trans. ASME *74*, 23-9 (Jan. 1952). A process called "electroventing," for controlling the porosity of sheet materials, is described. Electroventing consists of passing electric sparks through the sheet material in such a manner as to produce a desired distribution of holes, and holes of a specified size. The combination of size of holes and number of holes will determine the fluid-flow characteristics of any material. This paper deals specifically with air flow through plastic sheet materials, together with an account of how the porosity may be controlled by electroventing.

PLASTICS VERSUS ZINC DIE-CASTING. Plastics (London) *17*, 219-21 (Aug. 1952). An economical method for coating plastic moldings with chromium is described which makes possible increased competition with zinc die-castings for some applications.

Applications

SYNTHETIC RESINS FOR THE FOUNDRY. Plastics (London *17*, 231-2, 234 (Aug. 1952). The use of various types of resins for bonding foundry sand cores is reviewed.

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

MOLDING. J. A. Miller. U.S. 2,605,-506, Aug. 5. Method of molding nylon or vinyl resins without plasticizers.

FLOOR COVERING. R. E. Eshenaur and C. L. Brockman (to Glenn L. Martin). U.S. 2,605,514, Aug. 5. Sealable vinyl resin floor panel.

SHEETING. W. H. Aiken and A. L. James (to U.S.). U.S. 2,606,131, Aug. 5. Coated cellulose sheet, resistant to warfare gases.

COPOLYMER. P. E. Marling (to Monsanto). U.S. 2,606,161, Aug. 5. Styrene-alkyd resin copolymer.

RESIN COMPOSITIONS. D. H. Coffey, O. B. Edgar, T. J. Meyrick, and J. T. Watts (to Imperial Chemical Industries). U.S. 2,606,162, Aug. 5. Isocyanate-modified polyesters and vinyl chloride polymers.

INTERPOLYMERS. E. D. Morris and G. A. Griess (to Dow). U.S. 2,606,-163, Aug. 5. Interpolymers of styrene with styrene-butadiene copolymers

RESIN. S. J. Hetzel (to Sun Oil). U.S. 2,606,167, Aug. 5. Polyvinyl acetal-acetate plasticized with 1,5-pentanediol difuorate.

SOLUTIONS. G. E. Ham (to Monsanto). U.S. 2,606,168, Aug. 5. Solutions of acrylonitrile polymers in tetrakis (N,N-dimethylamido) pyrophosphate.

SULFONE RESINS. C. Roney (to Ansul). U.S. 2,606,169, Aug. 5. Olefin-sulfur dioxide resin having diphenyl phenyl phosphinate incorporated therewith.

RESIN. S. J. Hetzel (to Sun Oil). U.S. 2,606,170-1, Aug. 5. Polyvinyl acetal-acetate plasticized with 1,5-pentanediol bis(cyclohexyl acetate), or 1,5-pentanediol diesters of kerosene oxidation acids.

INTERPOLYMERS. P. O. Tawney (to U.S. Rubber). U.S. 2,606,172, Aug. 5. Interpolymers of a di-2-albenyl maleate, a styrene, and a 2-alkenyl alcohol.

POLYSULFIDES. E. M. Fettes (to Reconstruction Finance). U.S. 2,606,-173, Aug. 5. Polysulfide polymers.

POLYMERIZATION. I. M. Kolthoff and C. W. Carr (to Phillips Petroleum). U.S. 2,606,174, Aug. 5. Emulsion polymerization using ultrasonic vibrations to effect emulsification.

POLYMERS. J. A. Price (to American Cyanamid). U.S. 2,606,175, Aug. 5. Polymerizates of 2-vinylbenzimidazole.

COPOLYMERS. W. R. Dunn (to U.S. Rubber). U.S. 2,606,176, Aug. 5. Acrylonitrile-isobutylene copolymers.

POLYVINYL CHLORIDE. J. Downing (to Celanese). U.S. 2,606,177, Aug. 5. Dehydrohalogenation of polyvinyl chloride.

EMULSIFIERS. M. Kosmin (to Monsanto). U.S. 2,606,178, Aug. 5. Alkali sulfate salts of ethylene oxide condensates as emulsifiers for styrene polymerization.

CATALYSTS. T. Boyd (to Monsanto). U.S. 2,606,179, Aug. 5. Polymerization of ethylene in the presence of a sodium alkenyl.

POLYVINYL CHLORIDE. C. A. Nielson, F. Leonard, and I. Cort (to United States). U.S. 2,606,325, Aug. 12. Age and stain-resisting article of polyvinyl chloride.

BOX. K. W. Irvan (to Orchard Industries). U.S. 2,606,708, Aug. 12. Molded plastic box.

PHOTOGRAPHIC ELEMENTS. F. P. Alles and W. R. Saner (to Du Pont). U.S. 2,606,832, Aug. 12. Photographic elements having an anchoring substratum of water-soluble vinylpyridine polymer.

PHOTOGRAPHIC ELEMENT. W. R. Sauer (to Du Pont). U.S. 2,606,834, Aug. 12. Photographic element containing water-insoluble vinylpyridine polymer.

PHOTOGRAPHIC ELEMENT. A. B. Jennings (to Du Pont). U.S. 2,606,835, Aug. 12. Photographic element containing salicylacetal of polyvinyl alcohol and O-sulfobenzaldehyde acetal of polyvinyl alcohol.

SILANE RESINS. H. A. Clark (to Dow-Corning). U.S. 2,606,837, Aug. 12. Coating a bread pan with a phenyl methyl polysilane.

NYLON FABRIC. H. A. Van Etten (to Du Pont). U.S. 2,606,845, Aug. 12. Applying N-alkoxymethyl polyhexamethylene amide to nylon to aid adhesion to polyvinyl chloride.

ADHESION. G. Kraus and A. Conciatori (to General Motors). U.S. 2,-606,852, Aug. 12. Using halogenated polymethylpentadiene to aid adhesion of rubber to metal.

MOLDING PLATE. C. N. Jenkins (to Carbide and Carbon). U.S. 2,606,855, Aug. 12. Preparation of embossing plates for plastic materials.

SEALING. R. C. Hurrey and H. R. Montague. U.S. 2,606,856, Aug. 12. Heat sealing radio-frequency device.

SILANES. H. A. Clark (to Dow Corning). U.S. 2,606,879, Aug. 12. Alkyl siloxanes.

RESINS. J. A. Yourtee (to American Viscose). U.S. 2,606,880, Aug. 12. Aminoplast resins with esters of oxanilic acid as latent catalysts.

POLYMERIZATION. M. Zief and E. Yanovsky (to United States). U.S. 2,606,881, Aug. 12. Polymerization of polyallyl ethers of polyhydroxy compounds.

RESINS. M. DeGroote and A. F. Wirtel (to Petrolite). U.S. 2,606,882, Aug. 12. Mixtures of oxyalkylated resins and partial acidic esters.

RESINS. F. W. Hoover (to Du Pont). U.S. 2,606,883, Aug. 12. Air-drying oily resin.

ADHESIVE. E. E. Mayfield (to Hercules). U.S. 2,606,884, Aug. 12. Adhesive comprising vinsol and butadiene-acrylonitrile rubber.

RESINS. A. F. Schmutzler (to American Cyanamid). U.S. 2,606,885, Aug. 12. Modified dicyandiamide resins.

RESINS. S. F. Pearce (to Imperial Chemical). U.S. 2,606,887, Aug. 12. Modified phenol-furfural molding compositions.

RESINS. J. H. Williams and T. Ward (to Imperial Chemical). U.S. 2,606,-

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888-9, Aug. 12. Phenolic molding compositons.

RESINS. O. L. Polly and O. D. Cunningham (to Union Oil). U.S. 2,606,890, Aug. 12. Modified alkyd resins.

COPOLYMERS. S. P. Rowland (to Rohm and Haas). U.S. 2,606,891, Aug. 12. Styrene-maleic copolymers.

POLYMERS. E. L. Kropa and A. S. Nyquist (to American Cyanamid). U.S. 2,606,892, Aug. 12. Isocyanate compositions.

POLYMERIZATION. W. B. Reynolds, J. E. Wicklatz, and T. J. Kennedy (to Phillips Petroleum). U.S. 2,606,893, Aug. 12. Emulsion polymerization of vinylidene compounds.

VINYLIDENE CHLORIDE. G. Pitzl (to Du Pont). U.S. 2,606,894, Aug. 12. Solvent soluble vinylidene chloride-acrylonitrile.

POLYMERIZATION. G. C. Bailey (to Phillips Petroleum). U.S. 2,606,940, Aug. 12. Polymerization of olefins in the presence of nickle oxide and silica gel.

HEAT SEALING. T. W. Winstead. U.S. 2,606,987, Aug. 12. Heat-sealing element for thermoplastic film.

HAIRBUSH. E. J. Sullivan and A. B. Snyder (to Owens Brush). U.S. 2,607,064, Aug. 19. Hairbrush, the back and bristles of which are polyethylene.

TUBE CUTTER. C. E. Slaughter (to Extruded Plastics). U.S. 2,607,074, Aug. 19. Shearing device for extruded plastic tubing.

EXTRUDING. F. E. Dulmage (to Dow). U.S. 2,607,077, Aug. 19. Mixing torpedo for plastics extruders.

TUBING. M. L. Grimes. U.S. 2,607,078, Aug. 19. Apparatus for making thermoplastic tubing.

MOLD. J. H. F. Stewart, U.S. 2,607,080, Aug. 19. Mold for producing plastic articles without flash.

ACRYLIC SHEET. R. S. Taylor (to Du Pont) U.S. 2,607,081, Aug. 19. Inhibition of polymerization during preparation of acrylic sheet.

CORRUGATED FABRIC. B. H. Foster (to U.S. Rubber). U.S. 2,607,104, Aug. 19. Triple-ply corrugated fabric.

CELLULOSE ACETATE. C. R. Fordyce and B. E. Gramkee (to Eastman Kodak). U.S. 2,607,704, Aug. 19. Film that is formed from cellulose acetate solution.

FABRIC SHEETS. R. J. Nebesar (to Universal Molded Products). U.S. 2,607,708, Aug. 19. Resin impregnated and coated fabric.

BONDING MATERIAL. N. H. Simpson and W. D. Smith (to Consolidated Vultee). U.S. 2,607,709, Aug. 19. Woven nylon-glass fabric impregnated with phenolic resin used for metal bonding.

RECORDING TAPE. A. F. Schmelzle and E. E. Eastwold (to Minnesota Mining). U.S. 2,607,710, Aug. 19. Plastic recording tape.

ADHESIVE TAPE. J. O. Hendricks (to Minnesota Mining). U.S. 2,607,711, Aug. 19. Adhesive tape.

EXTRUSION COATING. R. C. Sturken (to F. W. Eagan). U.S. 2,607,712, Aug. 19. Machine for extruding a coating onto a web.

GLASS MATS. C. A. Smucker (to Owens-Corning). U.S. 2,607,714, Aug. 19. Glass fiber mats interbonded with soluble fiber.

FABRIC FASTENER. G. Waldes (to Waldes Kohinoor). U.S. 2,607,715, Aug. 19. Plastic fabric fastener tape.

CONDENSATES. R. L. Woodruff, W. T. Stewart, and W. Lowe (to California Research). U.S. 2,607,737, Aug. 19. Condensates of 2 thiothiazole, formaldehyde, and alkyl phenol.

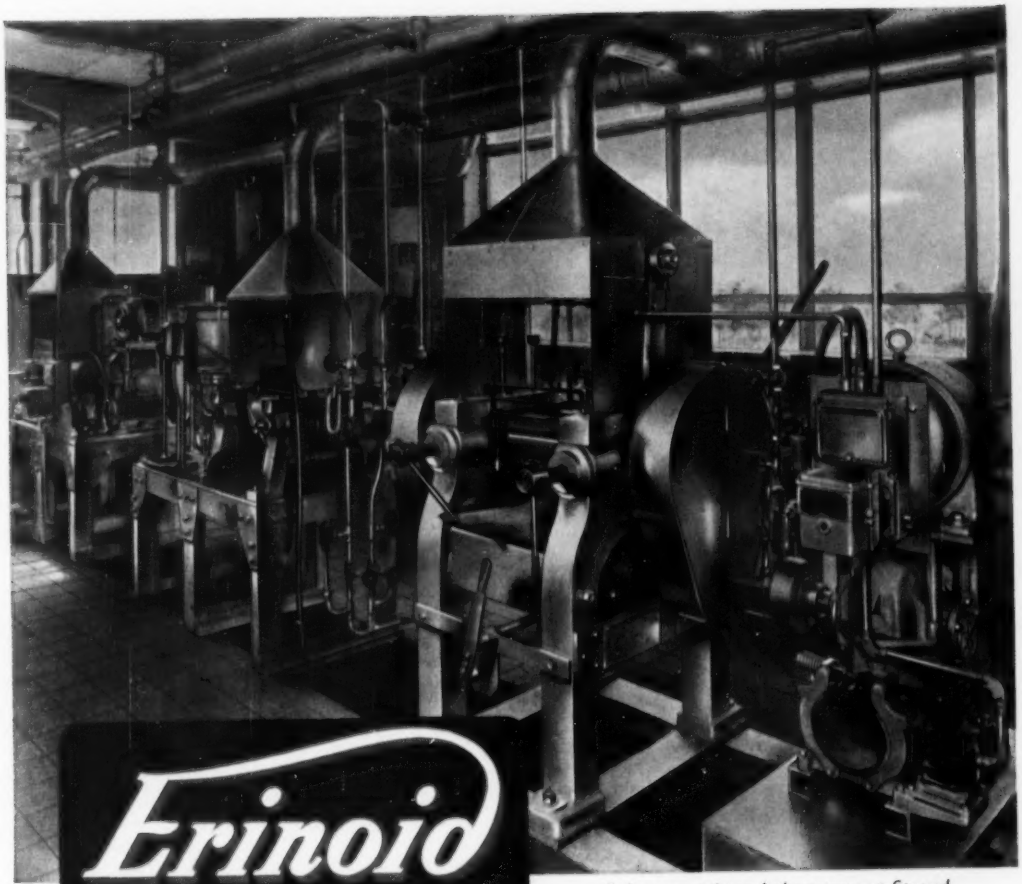
INTERPOLYMERS. L. E. Wakeford and D. H. Hewitt (to Sherwin-Williams). U.S. 2,607,749, Aug. 19. Interpolymers of styrene and polyhydric alcohol esters of a drying oil prepared in the presence of a terpene.

RESIN. L. H. Wilson and C. G. Landes (to American Cyanamid). U.S. 2,607,750, Aug. 19. Coprecipitation of thermoplastic resin with cationic amine-aldehyde polymers.

ACRYLONITRILE. J. V. Flanagan (to Du Pont). U.S. 2,607,751, Aug. 19. Acrylonitrile polymer dissolved in a dicarboxylic acid anhydride.

RESIN. W. W. Crouch and J. F. Howe (to Phillips Petroleum). U.S. 2,607,752, Aug. 19. Resin of sulfurdioxide and an unsaturated compound which reacts to form a heteropolymeric resin.

COPOLYMERS. E. K. Ellingboe and H. S. Rothrock (to Du Pont). U.S. 2,607,754, Aug. 19. Copolymer of



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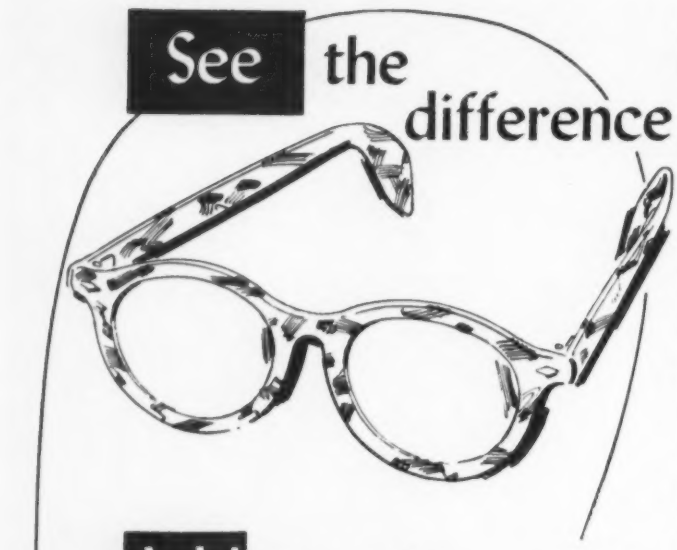

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RESINS. R. H. Bunnell (to Libbey-Owens-Ford). U.S. 2,607,755, Aug. 19. Silicone-alkyd resin.

STABILIZERS. T. F. Anderson (to Libbey-Owens-Ford). U.S. 2,607,756, Aug. 19. Polyesters stabilized with l-aryl-azo-naphthol sulfonic acids.

RESIN. M. W. Harmon (to Monsanto). U.S. 2,607,757, Aug. 19. Phenolthiazyl thio methyl urea resins.

RESINS. J. C. Hillyer (to Phillips Petroleum). U.S. 2,607,758, Aug. 19. Thermoplastic resin from furfural and morpholine.

CATALYSTS. J. A. Yourtee (to American Viscose). U.S. 2,607,759, Aug. 19. Salts of hexamethylenetetraminium bases as latent curing agents.

COPOLYMERS. H. S. Rothrock (to Du Pont). U.S. 2,607,760, Aug. 19. Copolymerized allyloxyacetic acid.

RESINS. R. B. Seymour (to Industrial Research). U.S. 2,607,761, Aug. 19. Reaction products of alkylene oxides and synthetic polymeric carboxylic acids.

POLYMERS. A. H. Bowen (to Monsanto). U.S. 2,607,762, Aug. 19. Water-soluble styrene-maleic anhydride heteropolymers.

POLYVINYL ALCOHOL. E. P. Czerwin and L. D. Martin (to Du Pont). U.S. 2,607,765, Aug. 19. Reaction of polyvinyl alcohol with boric acid.

CELLULOSE ESTERS. W. H. Groombridge, H. Bates, and J. W. Fisher (to British Celanese). U.S. 2,607,771, Aug. 19. Production of these esters.

CELLULOSE DERIVATIVES. C. H. Rigby (to Imperial Chemical). U.S. 2,607,772, Aug. 19. Production of powdery carboxymethyl cellulose.

SILICON RESINS. L. H. Sommer (to Dow Corning). U.S. 2,607,792, Aug. 19. Dimethylpolysiloxane diols.

SILICON RESINS. L. H. Sommer (to Dow Corning). U.S. 2,607,793, Aug. 19. Organo silicon amides.

POLYACETALS. D. J. Fenne and M. Mugdan (to Distillers). U.S. 2,607,804, Aug. 19. Manufacture of polyacetals.

FILMS. G. Schneider and B. Andersen (to Celanese). U.S. 2,607,954, Aug. 26. Apparatus for forming gel-free thermoplastic films.

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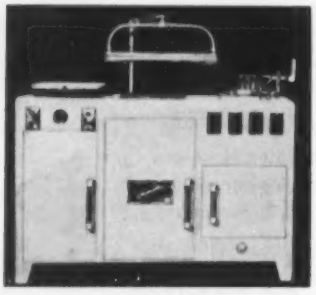
PRESS CONTROL—A new type of control, now available on the company's Multipress machine, has been announced by The Denison Engineering Co., Columbus, Ohio. Known as "Touch Control," it is a servo-type valving in the oil hydraulic press circuit that through its linkage with the hand control gives quick ram action. Close control over ram speed is accomplished through a hand control lever. The ram follows up to its maximum speed whether the lever is pressed rapidly or slowly. Minimum ram stroke is about 1/16 in.; maximum, 6 to 15 in., depending on the model Multipress. Neither valving nor linkage restricts the stroke or daylight of the press.

The pressure gage on the press indicates the exact force needed to perform the operation. For production line work the press can then be set accurately for continued application to that job-required pressure.

MASTER PATTERN PRODUCER—Vibrator, vacuum table, drying oven, and melting pots are combined in one machine, known as the "Vacurator" and manufactured by Guy P. Harvey & Son Corp., Leominster, Mass. The



machine was specially designed to allow manufacturers of dolls, toys, or other lightweight plastics items to make their own master patterns from original models, then use the patterns to make immediate samples while permanent cavities are being made. This process eliminates the making of duplicate samples by hand.

With the machine, plaster molds can be produced from the original model. From the plaster mold, the operator can immediately make duplicate models from sheet stock, using the machine's infra-red lamps and vacuum table.

Kirksite cavities can then be made for immediate sample production. Master patterns of Carobase or dental stone can be formed from the plaster molds to obtain pressure cast cavities and cores. Cast resin patterns for duplicating machines can also be produced.

ENGRAVERS' COPY DIAL—A master copy dial that provides 41 characters for quick change engraving in any engraving machine has been announced by H. P. Preis Engraving Machine Co., 191 Industrial Branch, Hillside, N. J. The dial is turned by the center knurled knob and the ratchet lever lock is readily released with one finger. The lock operates by means of a spring-held ratchet.

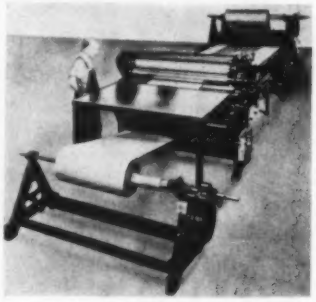
Mounted on the copy table of any engraving machine, the first letter or character is positioned for engraving. Then each succeeding character falls into place correctly as the dial is rotated. For straight line spacing, the copy table must move ahead a space for each character.

Designated as Preis-Panto Master Copy Dial Model No. 1, the overall size is 10¼ by 11¼ in. Thickness is ⅜ in., exclusive of the knob. The dial comes with ⅜, ½, or ¾ in. master copy characters in any one of several different styles.

LAMINATING MACHINE—A combination conveyor gluing machine and laminator, which will laminate plastics, cork, metal, paper, and other materials, is an addition to the line of the Potdevin Machine Co., 285 North St., Teterboro, N. J. The machine is 50 in. wide and is designed for continuous lamination of sheets and webs. Materials of varying thickness can be combined.

Coatings of adhesive are easily controlled by a single adjustment of a dial. For hot glues an electric glue heater in the tank keeps the adhesive at the correct consistency. The tank is removable for quick cleaning.

An over-running clutch and auxiliary drive on the coating unit permits the coating rollers to run continuously. This eliminates the possi-



bility of adhesive drying on the rollers. A single adjustment controls the pressure over the entire surface of the combining rollers. Equipped with two unwind stands to handle 40 in. diameter rolls of material, the machine has a shaft type rewind and Reeves variable speed drive. A tightening device is provided for adjustment of the canvas conveyor belt.

The machine is constructed with heavy cast iron frames. Overall dimensions are approximately 22 ft. long, 6 ft. wide, and 7 ft. high.

DICING MACHINE—Featuring a "notched-knife" principle of cutting sheet plastic into cubes, a new dicing machine has been developed by the Cumberland Engineering Co., Inc., Dept. N2, P. O. Box 216, Providence, R. I. This method supersedes the former method of slitting sheet stock into strands and then cutting the strands into cubes.

The machine is equipped with a pair of power driven feed rolls, one stationary knife, and four rotating knives. For special applications requiring high rates of feed, eight rotating knives are used.

Input speed of the dicer ranges from 10 to 125 ft. per min., depend-

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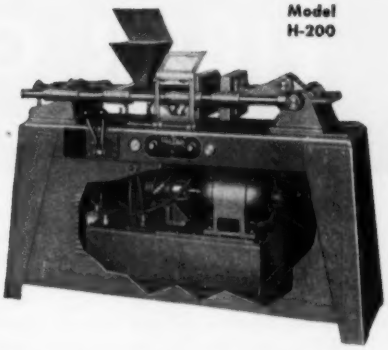

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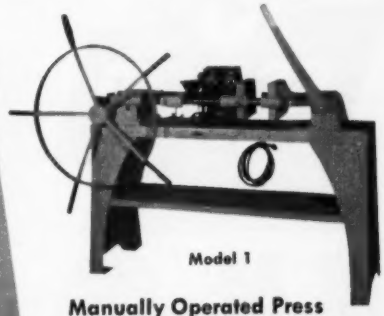

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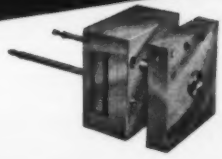

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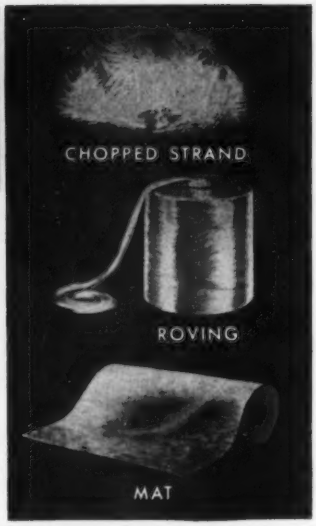

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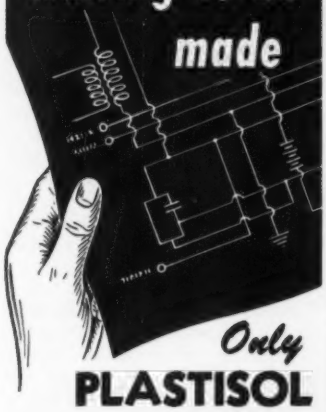

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STANLEY Industrial Coatings
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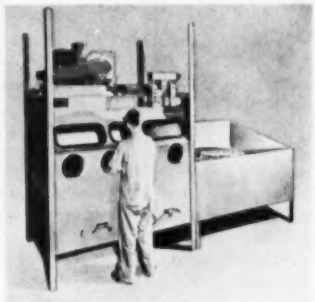
LACQUERS JAPANS SYNTHETICS ENAMELS

ing on requirements. Various types of plastics sheet stock can be diced into a wide range of cube sizes.

WET BLASTING MACHINE—Known as Model 64 Liquamatte, a new wet blasting machine is now being manufactured by American Wheelabrator & Equipment Corp., 1254 S. Byrkit St., Mishawaka, Ind. The machine is intended for all precision cleaning and finishing applications involving large and heavy pieces.

Applications of the machine are in the manufacture and maintenance of forging, die-casting, and drawing dies, and of plastic and glass molds; reconditioning of plant engines and oil burners; cleaning jet engines



after shake-down tests; surfacing tools, such as long broaches, before and after plating; blending different types of finishes on aluminum; removing heat treat scale; and deburring.

This machine, approximately 6 ft. long by 7 ft. deep by 9 ft. high, will handle single pieces or loads of pieces up to 3500 pounds. It has 49 by 36 in. counter-balanced doors and a 6 ft. accessory tank to receive the parts from the blast chamber for rinsing.

The machine has a vertical pump for slurry agitation and recirculation which is positioned to eliminate fittings which are usually necessary for the inspection of the pump. The pump is always primed by flooded-type suction.

An Abrasostat is available on the machine which tells at a glance the number of blasting hours the abrasive has been in the machine. When the abrasive requires changing, an air ejector is available for blowing the slurry through a length of hose to either a sump pit or barrels.

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ATLAS Type "E" High Pressure Reducing Valve

This remarkable valve reduces pressures as high as 6,000 lb. per sq. in. *without* shock—air, water, or oil.

The Product of SPECIALISTS.

This valve was not developed "over night." It came gradually, perfected by specialists who have been making regulating valves EXCLUSIVELY for more than a half century.

This Type "E" is an excellent example. Its body, for instance, is made of the strongest forged steel. That wonderful metal STELLITE is used for parts subject to the most severe abrasion and corrosion—the main valve and the seat ring. Other internal parts are of hard chromium plated stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. And so on.

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☐ Exhaust Control Systems
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☐ Oil Control Cocks
☐ CAMPBELL Boiler Feed Water Regulators
☐ Humidity Controllers
☐ Balanced Valves
☐ Thermostats
☐ Control Valves

Name .....
Firm .....
Street .....
City ..... State .....

BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Maleic Anhydride Derivatives," by Lawrence H. Flett and William Howlett Gardner.

Published in 1952 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. 269 pages. Price $6.50.

Characteristic reactions of the carbon-carbon double bond, as well as the other reactions of the malyl group, are reported. Selected types of reactions of the chemistry of the double bond, basic to the synthesis of almost all industrial organic chemicals such as dyes, detergents, perfumes, gasolines, and flavors, are contained in the book. Only the reactants and the end products are shown, not the reaction mechanism. The book is intended for students and research workers interested in synthetic organic chemistry, and for industrial chemists confronted with the problem of finding suitable chemicals for specific uses.

"Colloid Science I," edited by H. R. Kruyt.

Published in 1952 by Elsevier Press, 300 Park Ave., New York 22, N.Y. 389 pages. Price $11.00.

A review of the "irreversible" systems of colloid science is offered in this first of a two-volume series, the second of which deals with "reversible" systems. The book lays particular stress upon the harmony which exists between classical colloid science and the domain of macromolecular systems. Among the subjects covered are phenomenology of lyopholic systems; optical properties of colloidal solutions; electrochemistry of the double layer; electrokinetic phenomena; and the kinetics of flocculation.

"Hydraulics As Applied To The Machine Tool Industry."

Reprinted in 1952 by Product Service Dept., Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich. Order by number 935065. 96 pages. Price $2.00.

One of a series of textbooks, this volume offers information on pumps and valves, their maintenance and repair. Also discussed is the practical application of hydraulics to machines for the control of speeds and feeds. The lessons, which are illustrated with diagrams and tables, each conclude with a special homework assignment.

"Fundamental Principles of Polymerization—Rubbers, Plastics, and Fibers," by G. F. D'Alelio.

Published in 1952 by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 517 pages. Price $10.00

Designed primarily to summarize the fundamental principles of polymerization, this volume also attempts to reconcile the discrepancies of terminology that have arisen in earlier literature. Some of the main subjects dealt with are polymerization reactions and functionality; the existence of macromolecules; polymerization processes; kinetics of polymerizations; reaction loci in polymerization systems; and copolymer compositions and stability of polymers.

Educational film guide—Information as to the issuance and the subject matter of educational films are contained in these two guides—the Educational Film Guide for 16mm film and the Filmstrip Guide for 35mm film. Each issue of the guides, which appear quarterly and in an annual, contains an alphabetical listing, both by titles and subject matters, of recently published or current films. Pricing information for the service is available from *H. W. Wilson Co., 950-72 University Ave., New York 52, N. Y.*

Chemistry—Eleven books dealing with various phases of chemistry and chemical applications are cataloged and described in this 8-page publisher's list. Included among the subjects covered are styrenes; glycols; the physical chemistry of surface films; soluble silicates; textile chemicals and auxiliaries; wood chemistry; phosphoric acid; and chemical engineering techniques. Prices and chapter headings for each of the books are also given. *Reinhold Publishing Co., 330 W. 42 St., New York 36, N. Y.*

Plastic household appliances—Various household appliances and fixtures molded of either Beetle, Laminac, or Melmac are illustrated and described in a booklet entitled "Thirty More Manufacturers." Each of the brief descriptions of products emphasizes the particular advantage of the plastic that makes it suitable for that particular application. Names of molders or manufacturers of the products are also included. *American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.*

Polyethylene bottles—Illustrations of typical consumer and industrial applications are contained in this 8-page brochure devoted to the functional characteristics and design considerations of the squeezable polyethylene container. Data on closures and accessories and printing and labeling techniques are also given. *Plax Corp., West Hartford, Conn.*

Hydraulic cylinders—Designed for aiding engineers and designers in locating desired cylinders and mountings, two illustrated color bulletins survey the field of hydraulic cylinders. Bulletin A-105G concentrates on 200 p.s.i. non-rotating air cylinders; bulletin H-104G concerns non-rotating high pressure hydraulic cylinders, 2000 p.s.i. and up. Both of the 8-page bulletins present engineering, design, construction, and mounting data, including all mounting drawings and dimension tables. *Miller Motor Co., 2040 N. Hawthorne Ave., Melrose Park, Ill.*

Cork products—The structure of cork, its compositions, physical characteristics, and products made from both natural and cork compositions are presented in an illustrated 4-page booklet. Also offered are data on the density, tensile strength, compression, and coefficient of friction of natural cork, its physical properties, uses and sizes. *Dodge Cork Co., Inc., Lancaster, Pa.*

Engraving machines—The various engraving machines in the company's line are described and illustrated in this 6-page folder. Included is a

HOW TO EXTEND YOUR PLASTICIZERS!

Use S/V SOVALOID C and Cut Plasticizer Bills 30 to 90%!

If you are using conventional plasticizers for Vinyl resins and Buna N, you can actually cut your costs 30 to 90% by extending these expensive plasticizers with *S/V Sovaloid C!*

S/V Sovaloid C costs but a fraction of ordinary, ester-type plasticizers—yet has many processing advantages. It is completely compatible with all Vinyl and Buna N compounds. It provides effective oil-resistant qualities . . . imparts flexibility . . . increases tensile strength . . . won't migrate from the finished product.

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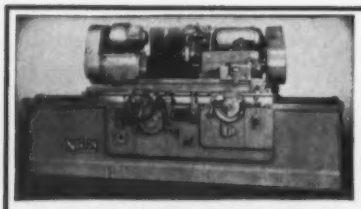
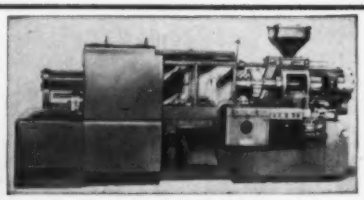


Norton Co., Manufacturer of Grinders, Specifies Marvel Synclinal Filters as Standard Equipment.

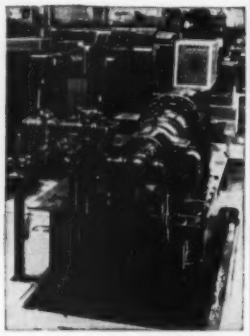


Superior Plastic Div. of Commonwealth Plastics, User, Installs Marvel Synclinal Filters on Their Hydraulic Injection Molding Presses.

Hufford Machine Works, Inc., Manufacturer of Stretch-Wrap Forming Machines, Specifies Marvel Synclinal Filters as Standard Equipment.

Euclid Road Building Machinery Co., Manufacturer, Specifies Marvel Synclinal Filters as Standard Equipment.

Hamilton Bridge Co., Ltd., Manufacturer of Bolsters, Specifies Marvel Synclinal Filters as Standard Equipment.



U. S. Steel, User, Installs Marvel Synclinal Filters to Protect Their Hydraulic Equipment.

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Line Type (cutaway)

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The O. E. M. Choice of
Over 300 Manufacturers

3 OUTSTANDING REASONS WHY:

REDUCED COSTS — Simple design, no moving parts to wear, nothing to keep in stock make Marvel Synclinal Filters an outstanding economy factor.

EASY MAINTENANCE — Marvel Synclinal Filters may be easily disassembled, cleaned and reassembled by any workman, maintenance "downtown" is reduced to the absolute minimum.

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A SIZE FOR EVERY NEED

Available in sump and line types, capacities from 5 to 100 g.p.m. Monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe connections.

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625 W. Jackson Blvd. Chicago 6, Ill.

three-purpose machine which can be used for engraving on plastics, for electrically marking, and for acid etching. *H. P. Preis Engraving Machine Co., Hillside, N. J.*

Bubble caps and risers—Engineering data on 270 standard styles of bubble caps and risers for fractionating towers and stills are presented in a 24-page catalog. Included are methods of bubble tray assembly. The catalog (No. 52) also offers information on processing equipment, as well as tubes, welded tubing assemblies, and manifolds which the company fabricates from a range of heat- and corrosion-resistant sheet alloys. *The Pressed Steel Co., Wilkes-Barre, Pa.*

S.P.I. symposium—A 116-page symposium of the technical program presented at the Ninth Annual Conference of the Pacific Coast Section of S.P.I. has been put into book form both for the convenience of the delegates and as a ready reference work. In addition to charts and diagrams to illustrate many of the papers presented, a list of the officers and members of the Northern and Southern California chapters is included. A few hundred copies are still available at $1.00 from *Pacific Coast Section, S.P.I., Lee T. Bordner, Chairman, 544 E. 31 St., Los Angeles, Calif.*

Processing equipment—Machines for processing plastics and rubber are described and illustrated in this eight-page booklet. Among the machines discussed are calenders, mills, plasticators, pelletizers, and tubing and straining machines. Also covered are two of the company's special services—the engineering of complete layouts of production machines, and a process-testing laboratory, where manufacturers can explore the possibilities of new processing techniques and the development of new products. *Farrel-Birmingham Co. Inc., Ansonia, Conn.*

Corrosion-resistant coatings—Designed to protect industrial equipment against corrosive conditions, the company's "Ricwilite 7100" phenolic resin coatings are described in this four-page illustrated pamphlet. The material, which is a cold temperature setting coating polymerized at room temperature by the addition of a catalyst before application, is discussed as to physical properties and the results of temperature and cathodic protection tests. *Ric-Wil Plastic Coating & Mfg. Corp., 1290 Euclid Ave., Cleveland 15, Ohio.*

Molding machines—The 50-year historical background of the company's development as a manufacturer of machines for injection molding and die casting, projectiles, pneumatic clamp tables, and other products, is described in this 24-page illustrated booklet, "Fifty Years of Achievement." *Projectile & Engineering Co., Acre St., London, England.*

Styrene monomer—A brief survey of the end uses of styrene monomer and the materials made from it is presented in this 40-page illustrated booklet. Discussed in the booklet are styrene-based dispersions; polyester resins; elastomers; styrene-modified alkyd-type resins; and styrenated oils. Charts are used to illustrate the function of styrene monomer derivatives in many diversified businesses. *Monsanto Chemical Co., St. Louis 4, Mo.*

Latex—Properties and applications of natural and synthetic latices and their compounds are described in this 23-page illustrated booklet. Discussed in the booklet are Hevea latex; GR-S latex; and natural and synthetic latex compounds. Plastisols and plasticizers are described as to properties and specifications. *Rubber Corp. of America, Latex Div., 274 Ten Eyck St., Brooklyn 6, N. Y.*

Styrene — Advantages, properties, and applications of styrene are offered in this 15-page color illustrated booklet. Technical data are presented in a series of charts. Color photographs illustrate various applications including liquid toilet soap and towel dispensers; soap dishes; egg postal containers; nursery toys; and fancy combs. *Kleestron, Ltd., West Halkin St., Belgrave Sq., London, S.W.1, England.*

Motor fuel storage—Data useful in overcoming corrosion and other difficulties in the handling and storage of motor fuels are given in this Government research report entitled "PB 106127, The Exchange of Water Between Hydrophobic Liquids and Air." Investigations by the Naval Research Laboratory as to the absorption by motor fuels of water from the air is discussed in this 16-page report, as is a new technique for measuring small quantities of water dissolved in motor fuels. The mimeographed report is available for 50¢ from *Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.*

Engineering economics—Results of research undertaken in six fields of engineering economics—industrial market research; raw materials studies; diversification studies; research planning; industrial logistics and plant location; and operations research—are described in this 16-page booklet. Case histories, involving the coordination of technology and economics, illustrate various survey assignments of the company in such fields as markets for new chemicals; utilization of industrial wastes; new fields of manufacturing; problems of company diversification; new uses for copper; and outlets for chemical apparatus. *Battelle Memorial Institute, Columbus, Ohio.*

Resin adhesives—Development, preparation, and advantages of resin adhesives are explained in this illustrated 6-page magazine reprint. Designed to acquaint the layman user of adhesives with the special properties and handling techniques of these labeling, sealing, and fabricating adhesives, the reprint lists methods of application and suggestions for obtaining proper results. *Paisley Products, Inc., 1770 Canalport Ave., Chicago 16, Ill.*

Silicone insulations—Class H insulating materials, made with the company's silicones, are described and discussed as to typical properties, applications, and availabilities in this illustrated 4-page leaflet. A detailed list of recommended Class H components is also given. *Dow Corning Corp., Midland, Mich.*

Safety equipment—Advances in industrial safety practices and equipment are described in two Government research reports. The first, "Fog Foam Studies" (PB 106708), reports on tests performed to determine the effect of hydraulic pressure on the fire extinguishing characteristics of fog foam, and discusses standards of performance for fog

Plastics for Defense and Industry

KNOW HOW — The "know how" approach to every phase of plastics engineering and production is, and continues to be, a major factor in the over quarter-century success of the Michigan Molded organization. It is one of many reasons that Michigan Molded's recommendations and performance in doing a plastic job well — justifies the continuing interest and confidence of America's users of all types of plastics.

MICHIGAN MOLDED PLASTICS, INC. DEXTER, MICHIGAN

Offices in Principal Eastern and Midwestern Cities.

foam nozzles. The second, "Investigation of Fires Originating in Aircraft Vacuum Systems" (PB 106754), describes the results of tests in which various vacuum piping systems were compared to determine the relative abilities of the systems to withstand internal fires. Information on both booklets available from *Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.*

Abrasive disks—Descriptions, specifications, applications, and care of abrasive disks and allied supplies and accessories are found in this 60-page booklet. Included are selection information, available types, standard markings, and a table giving recommended surface speed per minute in r.p.m. by diameters of disk. *Gardner Machine Co., Beloit, Wis.*

Motor speed controls—Technical information on the company's motor speed controls, including speed-torque curves and typical applications, is available in this 8-page illustrated folder. Basic element in these controls is a variable voltage autotransformer, used with a selenium rectifier and choke. A diagram of a sample installation is included. *General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.*

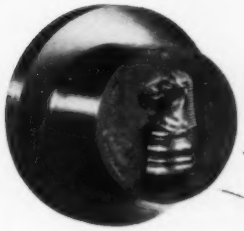
Diamond abrasives—Characteristics of diamond as an abrasive, together with data on the company's line of diamond abrasives and finishing accessories, are offered in this 8-page booklet. Illustrations show the primary applications of diamond for finishing, such as drawing die polishing; plastic mold finishing; cutting tool edge finishing; and mass-production polishing of component parts. *Abrasives Div., Elgin National Watch Co., Elgin, Ill.*

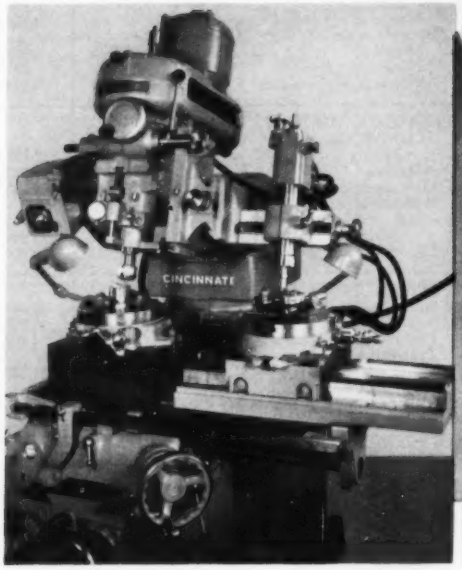
Phenolic resins—Charts and illustrations outlining the company's products in the fields of phenolic molding compounds, industrial resins, and coating resins are found in this 4-page illustrated brochure. Properties and uses of the molding compounds and industrial resins are listed in a chart in which the materials discussed are grouped as follows: general purpose; impact; nonbleeding; electrical; heat-resistant; and special property. *Durez Plastics & Chemicals, Inc., 8 Walck Rd., No. Tonawanda, N. Y.*

SENSITIVE AS A CAT'S WHISKER

IN TRACING *Fine* DETAILS IN MOLDS

HOB

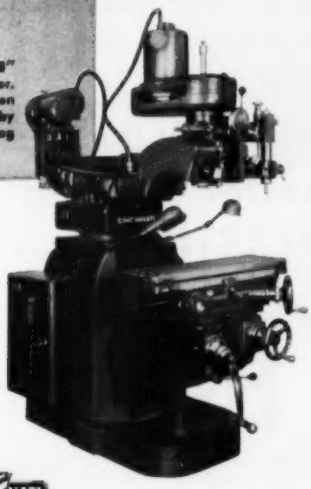




Hob for a three figure is milled on a CINCINNATI 8" x 18" Tool and Die Milling Machine, equipped with Duplex Rotary Table Attachment. Close-up of hob (upper left) illustrates how accurately every detail of the master (right) has been reproduced.

MASTER

CINCINNATI 8" x 18" Tool and Die Miller. Complete information may be obtained by writing for catalog No. M-1731.



Have you ever noticed the instantaneous response of a cat when his "whiskers" touch something? The depth tracing unit of a CINCINNATI 8" x 18" Tool and Die Miller is just as sensitive; it automatically reacts to a few ounces pressure. It's so sensitive that it will trace over the face of your watch without harming it in the least. The 8" x 18" light pressure tracing unit allows you to use easily worked "soft" masters, like wood, plaster and cement. This one feature alone gives the CINCINNATI 8" x 18" a big advantage in milling medium-sized drop forging dies, hobs, molds and metal patterns. Want more information? Write for catalog No. M-1731, or for brief data look in Sweet's File for Mechanical Industries.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTIC AND SYNTHETIC RESIN PRODUCTION From Statistics Compiled

Materials	*Total p'd'n. first 8 mos. 1952*	*Total sales first 8 mos. 1952*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	6,675,542	6,717,897
0.003 gage and over	5,893,388	5,817,971
All other sheets, rods, and tubes	3,546,623	3,312,395
Molding, extrusion materials	35,082,305	34,785,541
Nitrocellulose:		
Sheets	3,274,565	2,855,523
Rods and tubes	514,316	637,452
Other cellulose plastics[b]	4,896,461	4,541,625
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	40,509,725	27,252,730
Adhesive	26,684,560	24,932,379
Molding and casting materials[a]	102,284,666	89,990,731
Protective coatings (modified and unmodified except by rosin)	17,216,558	15,004,672
Miscellaneous uses	38,962,412	36,109,162
UREA AND MELAMINE RESINS:		
Adhesives	50,319,174	49,943,293
Textile-treating resins	20,956,217	20,368,766
Paper-treating resins	14,188,616	14,007,605
Protective coatings, modified and unmodified	13,943,785	11,198,589
Miscellaneous uses, including laminating and molding[c]	33,280,132	37,233,867
STYRENE RESINS:		
Molding materials[a]	159,013,405	137,134,407
Protective coatings, modified and unmodified	43,824,315	44,602,420
Miscellaneous uses	44,456,088	38,275,562
VINYL RESINS:[d] Total	277,565,792	252,469,244
Sheeting and film (resin content)[e]		100,151,948
Adhesives (resin content)		10,410,003
Textile and paper-treating resins (resin content)[f]		26,789,014
Molding and extrusion materials (resin content)		85,517,886
Protective coatings (resin content)		12,902,296
Miscellaneous uses (resin content)		18,698,097
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	113,111,665	112,860,245
MISCELLANEOUS SYNTHETIC PLASTICS AND RESIN MATERIALS:		
Molding materials[a, g]	65,968,682	62,581,470
Protective coatings[h]	33,634,559	33,810,665
All other uses[i]	63,805,245	62,238,438

[a] Dry basis is designated unless otherwise specified. [b] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

IN POUNDS[a] FOR JULY, 1952, AND AUGUST, 1952 by U. S. Tariff Commission

July 1952		*August 1952*	
Production	*Sales*	*Production*	*Sales*
820,555	825,871	770,706	921,044
791,727	725,806	836,738	852,899
401,047	363,750	391,005	369,131
4,503,623	4,486,010	4,865,674	4,834,932
299,203	257,674	384,933	356,821
77,567	83,452	53,907	95,683
442,351	353,614	404,180	440,606
4,604,189	2,964,623	4,973,470	3,837,772
3,560,654	3,307,616	3,923,644	3,712,822
8,923,067	8,281,272	12,851,592	13,220,584
2,064,933	1,666,355	2,075,199	1,882,321
3,893,320	3,538,447	5,100,885	4,923,560
5,053,779	5,565,689	7,213,590	6,886,324
1,905,879	2,165,531	2,889,126	3,042,902
1,639,979	1,813,975	1,909,333	2,006,836
1,646,261	1,118,006	1,666,693	1,464,912
2,589,118	4,132,347	4,656,865	5,301,955
19,628,122	16,383,113	16,508,487	20,529,611
6,500,815	6,220,768	6,323,509	5,061,197
6,630,539	5,728,294	5,498,856	5,890,270
28,755,572	27,238,795	29,582,479	35,647,625
	10,503,657		13,281,670
	1,425,110		1,612,148
	2,980,205		3,902,520
	8,298,218		11,465,557
	1,736,151		2,331,275
	2,295,454		3,054,455
14,161,997	14,219,319	13,680,397	13,333,041
7,784,127	6,484,928	8,384,334	8,119,663
1,469,050	1,861,859	1,490,787	1,552,294
6,583,952	7,645,585	9,483,556	8,656,851

tion are given. [a] Prior to January 1951, statistics were given on the basis of total weight. [b] Includes data for spreader and calendering-type resins. [c] Includes data for acrylic, polyethylene, nylon, and others. [d] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [e] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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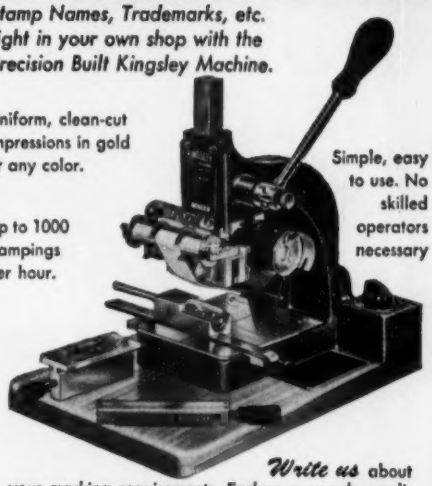

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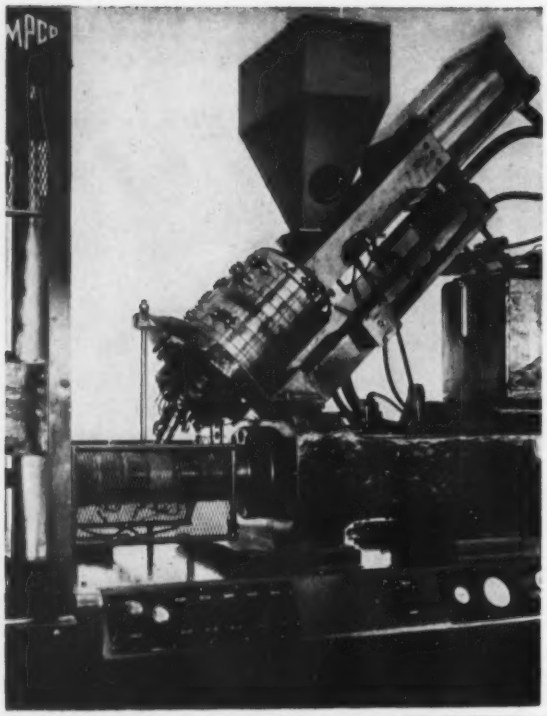

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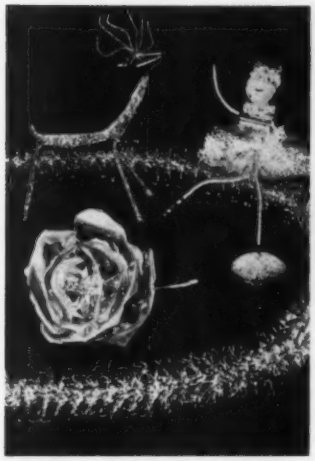

Novel display figures utilize glittering metallic acetate strips and tubing

Metallic Acetate

BY the use of Mirro-Brite metallic acetate, supplied by Coating Products, New York, N. Y., a series of novel display designs are being manufactured by Benel Products, New York, N. Y. The shining metallic colors of the material are contrasted against chalk tones to provide an eye-appealing unit.

Already available in the company's line are wreaths, an angel, a deer, a rose, and a ballerina. The wreaths, up to 72 in. in circumference, are formed of die-cut strips of acetate which form loops as they are twined about a tube of cotton wadding. The angel is of ¼ in. acetate tubing and a punched acetate apron bound together and flocked with gold-colored metallic acetate. A deer, 12 in. in length, utilizes flocked acetate over stems twisted to form antlers, body, and legs. The head is a loop of acetate, stapled together in position. In the 7-in. rose, metallic acetate petals with frosted edges—an effect achieved through a special process—bent into shape, are then joined over a pipe cleaner. The ballerina stands 11 in. high on a metallic acetate flocked pedestal. Chalk-colored punched acetate is pleated to form skirt and ruff. The crown is formed with acetate flocking liberally sprinkled over. Doll's bodice is loop of acetate over the body stem.

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Translucent Door

RESIN-impregnated wood covered with sheets of translucent reinforced plastic glass is the latest in door construction. The door, called Cover-Lite, was designed by W. D. Barton and is manufactured by Cover-Lite Co., Danville, Calif. Cover-Lite is made by laminating a piece of translucent fibrous glass to each side of a treated pine panel, standard door-size, built to a decorative cut-out design.

The wood frame is made of soft porous pine which is dried completely in an autoclave. The core, which is then readily absorbent, is pressure-impregnated with a phenolic resin. According to the manufacturer, this process makes a homogenous plastic structure that can no longer be classified simply as a "wood" core.

The surface polyester fibrous glass sheet called Alsynite is then fused electronically and chemically to the plastic impregnated core with heat and pressure to form a single unit. A permanent insoluble phenolic resin binder laminates the sheets to the resin-filled wooden core to form a complete seal which is reported to be as safe and sturdy as the strongest conventional door. It is warp-proof, shatter-proof, moisture-proof, and, of course, is not subject to corrosion.

Once installed, the translucent doors are said to be maintenance-free. The plastic coating on the pine core eliminates the necessity of repainting and the fibrous glass panels never have to be replaced.

The translucent door allows light to penetrate to otherwise dark areas without interfering with privacy and the shadow patterns add a novel design effect. Viewed in daylight from the outside, the door appears as an iridescent panel of fibrous glass. From inside, the shadow pattern can be seen. At night, the reverse is true —interior illumination makes the shadow pattern visible from the outside only.

Translucent fibrous glass allows light to pass through door for decorative effect

The door is available in five different core patterns, but individual designs will be made upon request. The reinforced plastic comes in six nonfading colors: rose, maize, leaf green, light green, aquamarine opalescent, and an off-white called "moon glow."

Standard tools and hardware are used to trim, fit, and hang the doors. They are easily installed by any carpenter using regular tools. The doors are made up in stock door sizes, but can also be made to order for out-sizes.

Architects who recently previewed this innovation in doors foresee endless possibilities for its use, because it blends well with most architectural styles and would add distinction to almost any building, be it commercial or residential.

Two of five patterned cores to which sheets of fibrous glass will be laminated

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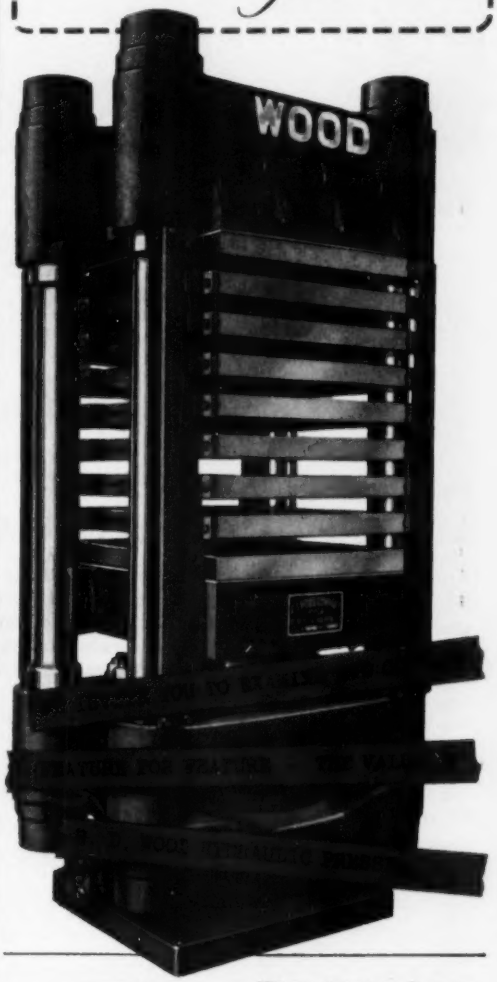

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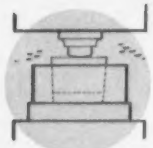

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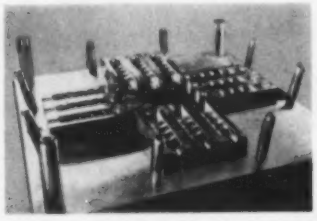

Here's what Windman Brothers said about SAMSON EXTRA on this job: "... from results so far, we have every reason to believe these molds will produce up to 5,000,000 parts. SAMSON EXTRA was easy to hob and machinability was excellent. A mirror finish was easily obtained. We are well pleased with your steel and find it *even exceeded your claims.*"

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Housed in Acrylic

RECENT years have witnessed a phenomenal growth of streamlined roadside stores which tempt the traffic-weary motorist. Among the companies active in this field is Whirla-Whip, Inc., Omaha, Neb., which offers its "Whirla-Whip in-a-Tub" in a choice of 50 flavors.

Recently this organization adopted a new type of dispenser featuring an attractively styled housing formed of acrylic sheet material. Fabricated by Geeco, Inc., St. Joseph, Mo., the dispenser supplants an earlier model which utilized heavy metal castings finished with porcelain enamel. With the metal unit, maintaining practical casting sizes and shapes proved difficult; also, great care was required not to chip the easily damaged porcelain enameled surface.

In redesigning the dispenser for plastics, requirements included appearance, durability, ease of cleaning, and the ability to withstand the acids in fruits, nuts, and candies used to flavor the product.

Geeco forms the main components of the housing of 3/16 in. white Plexiglas. After the heated sheet has been drawn into the cavity by vacuum, the male plug is lowered into position; compressed air forces the material against it.

Excess material, and that which is cut out for the front opening, are reformed into the small sign on top.

Acrylic housing for dispensing unit supplants earlier heavy metal model

Photos courtesy GoldE Mfg. Co.

Base of new slide projector is molded of phenolic; lift-off cover is high-impact styrene. When carrying the projector, the cover is secured to the base by a set of latches

Slide Projector

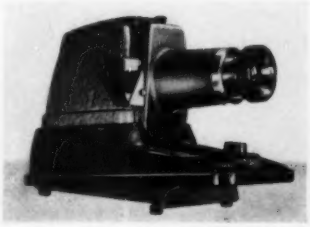
SEVERAL types of molded or extruded plastics are employed in the attractive new Coronet 200 watt 2 by 2 slide projector recently introduced by GoldE Mfg. Co., Chicago, Ill. Each plastic component was carefully chosen for its particular adaptability in the unit's design.

The base of the projector, molded of brown Durez 1544 medium impact phenolic, is produced in a two-cavity mold. A set of integral studs or projections molded in the front and back of the base lock securely to latches on the bottom of the cover when the unit is to be lifted and carried. Tapped bosses molded in the base provide assembly to the lamp housing by means of bolts. A metal platform with protective rubber feet is similarly assembled to the base, which is produced by Molded Products Corp., Chicago, Ill.

The handy lift-off type cover of the projector is injection molded of Dow 475 or Monsanto LT high impact styrene by American Plasticraft Co., Chicago, using a 32-oz. press. Light in weight and extremely sturdy, the cover has a recessed panel extending over the top and down the front and back surfaces. The same molder also produces the projector lens mounting barrel, which is molded of brown high-temperature Lustrex.

The expansion type handle for the cover, which lies flat when not in use, consists of a flat wire spring with a Vinylite insert and an outer spiral wrapping of extruded cellulose acetate butyrate. It is supplied by Superior Plastics, Inc., Chicago. Phenolic slide file boxes used in conjunction with the projector and phenolic parts for the slide changer mechanism are molded by The Richardson Co., Melrose Park, Ill.

Projector lens mounting barrel is molded of brown heat-resistant styrene



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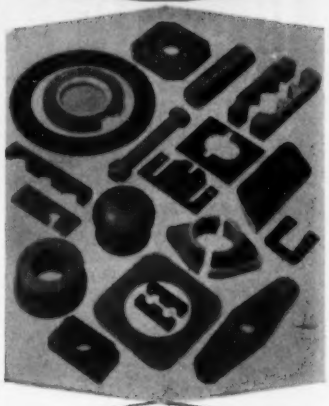

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The Heavens on Earth

PROJECTING the celestial bodies of the solar system upon a polyester resin impregnated fibrous glass hemispherical dome produces an illusion of the skies that facilitates the study of astronomy and celestial navigation problems.

The dome, which is molded by the Winner Mfg. Co., Trenton, N. J., has already been successfully installed, together with the projector system devised by the Spitz Laboratories, Philadelphia, Pa., in several naval and air force bases. In principle, the miniature installation is operated much the same as the major planetariums. The projector is located underneath the 20-ft. diameter dome and is capable of casting upon the dome's curved undersurface representations of stars, sun, moon, or planets, as well as the many astronomical devices used in celestial navigation.

Projector casts image of stars and planets on curved undersurface of dome

The dome consists of 60 right and left hand spherical triangles of resin impregnated fibrous glass laminate which are sufficiently rigid when interlocked to be supported permanently by only a base ring. In producing the sections, only two molds are used. A Selectron resin is first sprayed on the surface of the mold, and one ply of glass mat placed over the resin. After the glass fibers have been impregnated with more resin, cellophane placed over the laminate is used to work in the resin by hand so as to exclude any air pockets. The parts are removed after curing and trimmed and drilled.

Each of the 60 sections weighs only 10 lb. apiece, enabling the entire unit to be disassembled, moved, and reassembled at a new location. The triangular sections are flame- and moisture-resistant and capable of withstanding temperatures from -65° to 160° F. without distortion or undesirable effects.

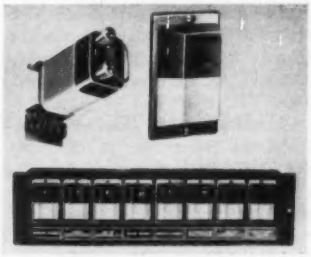
Automatic Alarms

MUCH of the complex equipment used by modern industry functions virtually unattended for long periods and at a considerable distance from supervisory personnel. By means of automatic alarm units for remote signaling of failure or abnormal operation of valves, pumps, heaters, etc., used in process operations, it is possible to detect operating troubles immediately.

Tigerman Engineering Co., Chicago, Ill., which manufactures a complete line of such equipment, has done an effective job of standardizing various parts of its Tel-Alarm equipment through "unitized" construction, permitting a variety of circuits from one basic alarm unit. This is made possible by a switchboard circuit header which is wired into the relay in different ways, simplifying manufacturing and producing a low cost, standardized assembly.

Major plastic components used in the Tel-Alarm equipment are engraved name plates of laminated acrylic sheet and "turret" style lenses molded of acrylic material. The name plates, 2¼ by 3 in., are available in translucent white, red, green, and amber or opaque black. Legends, made to order for individual installations, may be filled in, black or white. They are engraved by Engraved Products, Chicago. The shatter-proof acrylic plates, which offer excellent light transmission, fit into standardized metal frames. The turret lenses provide a large illumination area easily seen from either side as well as the front. They are designed to be mounted in pairs in the standard nameplate holders. Molding of the lenses is by Dayton-Rogers Co., St. Paul, Minn.

Alarm light (left) is behind acrylic lens (right); lenses mount in series (below)



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New England

UNDER the chairmanship of W. E. Parsons, president of Keyes Fiber Company, the New England Section of the Society of the Plastics Industry met in Manchester, Vermont, at the Equinox House October 16 and 17. Attendance reached a record-breaking 215 interested persons.

Chairman of the opening session on October 16 was Clifton J. Cowan, Cowan Boyden Corp. Leading speaker was B. A. Butryman, formerly of S.P.I.'s traffic committee and now traffic manager of Colt's Manufacturing Co. Mr. Butryman presented a comparison of motor freight rates as they affect plastics material and products in the New England area *vs.* other areas.

Moderated by F. Reed Esterbrook, Northern Industrial Chemical Company, was a debate on the resolution that engineering know-how in the field is more important to customer relations than engineering know-how in the plant. Speakers for the affirmative were: Prescott F. Huidekoper, Shaw Insulator Co., and Bernard Thal, The Bolta Co. For the negative were: Fred V. Murphy, Jr., Standard Plastics Co., and Jack G. Fuller, Jr., Hercules Powder Co.

The annual banquet of the New England Section was held with Mr. Parsons as toastmaster. The main speaker was the Hon. Gay H. Brown, former Justice of the Supreme Court of the State of New York, whose subject was "Wanted—Not Mice but Men." Gordon Brown, president of S.P.I. and vice president of Bakelite Co., briefly discussed the structure and utility of the Society.

Following the banquet there was a film presentation sponsored by Tennessee Eastman Co. and produced by Parfrey Plastics, Ltd., Melbourne, Australia. Three films showed the importance of water to the inland sections of Australia and showed the manufacture and installation of cellulose acetate butyrate pipe.

Chairman for the October 17 session was Winthrop A. Fleming, Standard Tool Company; leading presentation was a panel discussion of "High-Impact Polystyrenes."

Representatives on the panel

S.P.I. Fall Session

were J. S. Whitaker, Bakelite Co.; E. E. Ziegler, The Dow Chemical Co.; Charles J. Snyder, Koppers Co., Inc.; Ralph I. Dunlap, Monsanto Chemical Co. The information presented was essentially the same that appeared in the lead article of the November 1952 issue of MODERN PLASTICS Magazine.

A special session on education for careers in the plastics industry embraced a paper by Dr. Louis F. Rahm, director of the Plastics Laboratory at Princeton University, and one by Rupert E. Helmer, head of the plastics course at Central Technical School, Toronto, Canada. Dr. Rahm pointed out that under the sponsorship of S.P.I. and S.P.E. a recommendation was made to engineering schools throughout the country for the adoption of a course in plastics. He predicted that the full-fledged curriculum such as Princeton offers will be put into operation in other universities in the near future. The shortage of engineers with training in plastics makes this an opportune time, he said, for this industry to request educational institutions to supply men of the proper type.

Mr. Helmer outlined the very comprehensive course at vocational school level offered by his institution in Toronto and showed how the curriculum fits boys to step out into the plastics industry in processing, testing, and sales work.

R. B. Bennett, Treasurer of The Dow Chemical Co., presented a review of the Dow-Tarnell Financial Report, which shows the average financial position of various sizes of molding concerns and illustrates the trends of the past few years.

The arrangements committee, headed by W. E. Parsons, was composed of the following: George W. Carlson, Arrow-Hart & Gegeman Electric Co.; Clifton J. Cowan; David Guarnaccia, Monsanto Chemical Co.; R. A. Hoffer, General Electric Co.; Otto Morningstar, The Morningstar Corp.; George V. Sammet, Jr., Northern Industrial Chemical Co.; Joseph L. Sholkin, Beacon Plastics Corp.; Arthur A. Staff, Koppers Co., Inc.; W. B. Wallace, Mack Molding Co., Inc.; George W. Whitehead, Improved Paper Machinery Corp.

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SPEED ALLOY solved a troublesome pilot run problem for Taylor Fibre Co., Norristown, Pennsylvania, one of the largest manufacturers of laminated plastics, phenol fibre and special laminates. Since a mold was required on short notice to produce parts representative of production runs molded to extremely close tolerances, SPEED ALLOY was selected by Taylor Fibre Co. and subsequently machined by Wiedemann Machine Co., Philadelphia.

Using .030" feed and ⅜" cut at 65 s.f.m., only 35 hours were required for machining, the machinist barely noticing the difference between SPEED ALLOY and ordinary hot rolled plate. The as-machined finish was excellent, requiring only emery cloth polishing. The mold illustrated forms square and rectangular tubes as well as plain angles from the various types of laminated plastic materials used in the electronic industry.

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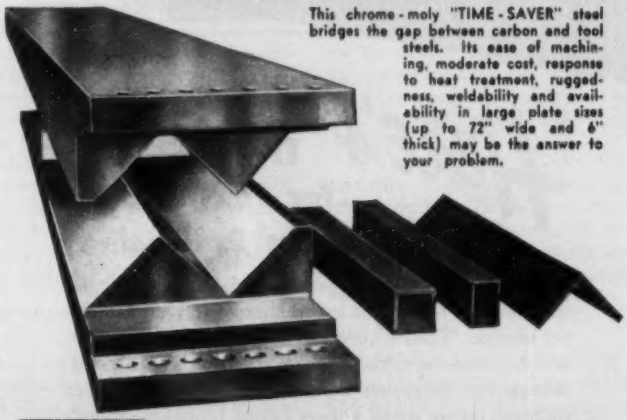

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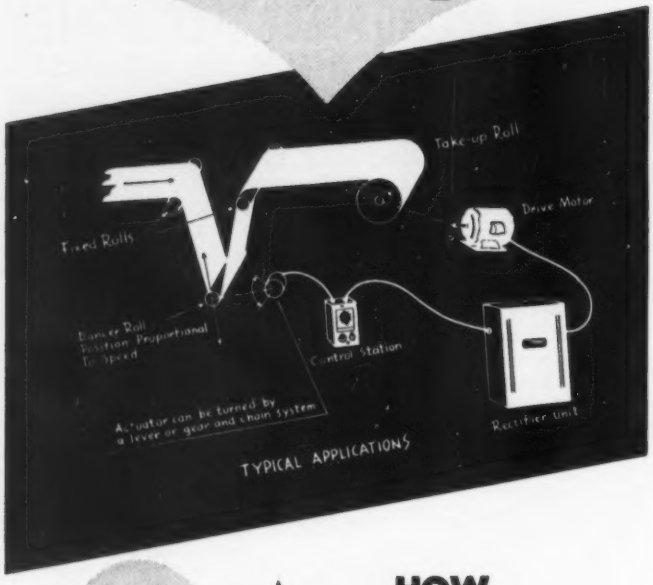

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WRITE

Servospeed
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Fluorocarbons

(*Continued from pp. 79-87*)

insulation in motors, generators, and transformers. These materials are also used as terminal board and printed circuit bases.

When used as electrical insulation, Teflon coated glass fabric makes possible equipment and instruments with greater output for the same size, that can be operated at high temperatures or overloads, or that are appreciably reduced in size and weight. These units are particularly practical in chemical plants and locations where high heat resistance is required.

Teflon finishes without the glass fabric have also attracted attention as non-stick coatings for various types of products. Bakers were among the first users. Once it is applied, a Teflon finish on pans is claimed to be permanent unless it is cut. Furthermore, it can usually be used not only for bread, but for cake or cookies as well.

It must be applied by spraying and then fused at 700° F. for a minute or two. Because of cost (it might add 50 to 100% to the cost of an ordinary pan) and the need for know-how, it is recommended that processing be done only by firms that are skilled in the application. Since the material costs from $70 to $100 a gal., use is limited to those jobs where it will work better than anything else. Molds for processing hard rubber and rubber footwear, rayon processing, adhesive rollers on bread wrapping machines, heat sealers, and printing ink rollers that get gummy are possibilities. In some cases, it will replace polished chrome—in some instances, it would have to last only 10 days to pay for itself, and that is easy for Teflon. However, it is difficult to bake big items, such as a steel roll for calendering rubber, because of the size of the equipment needed.

Despite all the handicaps, however, Tefion finishes for non-sticking applications are growing rapidly. As mentioned earlier in this article, however, more Teflon is being used for wire coating than anything else.

Kel-F

As mentioned before, Kel-F is a fluorocarbon that contains a small

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amount of chlorine—but that small amount of chlorine is the gimmick that makes it different from Teflon, a pure fluorocarbon, in many respects.

It was produced for Oak Ridge during the war, but no one was allowed to mention it until 1947. The first commercial plant for production of Kel-F was built by M. W. Kellogg shortly after 1947 and although production has been quadrupled since the original facilities were built, it is still quite small volume and 95% or more is channeled into military uses. Kellogg will have a new plant coming into production within the next month or so, which will reportedly have a capacity of 100 thousand lb. a month, but even a large part of that production is ticketed for military items.

There is not nearly as much literature nor information available about Kel-F as there is about Teflon. There are many reasons for this situation. All knowledge was kept under a secret cloak by Government decree for a long time. When the material finally became commercially available, there was never enough. The manufacturer has always had trouble keeping enough on hand so that it could be properly tested and evaluated for new and evergrowing markets. The cost in ton lots is $11 a lb. for low density compound, $12 for high density or injection molding type; plasticized is $13, dispersions are $15. Since its cost is considerably higher than Teflon, possible users took a look at the lower cost material first.

Experience Building Up

Most of the problems will soon be adjusted. Scores of molders and fabricators are now working with Kel-F in at least experimental lots to gain experience. The new plant will obviate the shortage problem for a time at least, and it is generally believed that large-scale production will lower the cost. Furthermore, the fact that it can be injection molded and thus speed up production will help reduce costs of finished products. Chemical engineers not connected with Kellogg say that the price of Kel-F might be halved in the not too distant future. These same engineers say that Teflon, too, might possibly be reduced by the same ratio at some not too distant date, thus maintaining its competitive cost-wise position. However, all this is speculation. Producers will not talk about such things.

Both Kellogg and Du Pont insist that each product will find its own market without undue competition, but any impartial observer can spot many applications where either material has the right properties for the job.

Heat Resistance

There are several striking differences between Teflon and Kel-F. The latter's top heat resistance for long service is about 390° F. in comparison to 500° F. for Teflon. Both materials have satisfactory properties at the low temperature of −320° F. But Kel-F can be injection and compression molded in slightly altered standard equipment. Teflon can be molded only by a sintering process. The cold flow characteristics are quite different. Kel-F does not have to be reheated to return to its original shape after the load has been released. Its lower coefficient of thermal expansion makes it more adaptable to uses re-

quiring metal inserts in molded parts.

Kel-F has greater tensile and impact strength than Teflon and can be made flexible or hard by heat treatment. Its electrical properties are comparable to Teflon, except at high frequency where its power loss is higher. Arc resistance is about 360 seconds.

Injection molding temperatures for Kel-F range from 440 to 550° F. Consequently, additional heating than provided for in standard machines is required around the nozzle and cylinder. The cylinder should be chromium plated and altered a bit to heat the material in thinner sections. Pressure is increased by using a somewhat smaller cylinder than normal. Molders say it is quite easy to make the alterations, especially if they have handled vinyl.

Chas. Kleiderer, vice president of Brilhart Plastics Corp., Mineola, N.Y., an experienced Kel-F molder, says that watching temperatures and constant attention to details are the secrets to Kel-F molding. He keeps his dies as hot as possible—well over 200° F. (the maximum for polystyrene is 150°)—and never attempts much more than from one- to three-min. cycles. Dirt is a big problem—the powder is transferred from drums in small closed containers so there is less danger of contamination from specks. One small speck can create rejects, and at $12 a lb., rejects are expensive.

Transfer molding is used for large parts, or for parts with delicate inserts. Compression molding is used for sheets which can be quenched, slow cooled, pigmented, or laminated with stainless steel gauze to produce various effects. Sheets up to ½ in. thick can be formed between highly polished stainless steel sheets without a mold.

Interchangeable Parts

The stability and accuracy possible in Kel-F moldings is illustrated by a combined job done in different plants. An 8- or 10-oz. electrical connector with inserts molded-in was compression molded in New England. The bushing for the connector was injection molded with molded-in threads in a Chicago plant. The external threads in the bushing matched up perfectly with the threads in the connector.

Conventional extruders are used for extruding Kel-F, but they are generally equipped with supplemental heating equipment capable of reaching temperatures of 550 to 650° F. Steam heat is not acceptable. The die is also generally heated more than in conventional extrusion. One extruder has produced film at a rate in excess of 200 ft. per minute.

Kel-F molding material can be supplied with a ground fibrous glass filler to give greater strength at higher temperatures—about 400° F. It is now the same price as regular material, but will eventually be less. Valves on oxygen or gas cylinders are one possibility for this type material, and, like Teflon mixtures, this is no doubt the beginning of a trend that will find Kel-F combined with all sorts of materials to create a variety of properties.

Coil forms molded from Kel-F are expected to be a leading outlet as soon as material is more available. They are stronger than Teflon and have an advantage over nylon because there will be no water absorption. Such coil forms would be the cat's meow in television sets be-

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cause of moisture resistance. But television makers are not yet willing to spend the extra cents that would be involved.

O-rings and gaskets in Kel-F would in most cases be quite as satisfactory as Teflon, for chemical resistance is almost as good; but up to now the difference in material cost has interfered. However, O-rings, are in rather wide spread use in grooved areas on shafts where they are needed to make a seal for liquid or corrosive chemicals.

Diaphragms of Kel-F are just in the beginning of a big future market. The fairly flat diaphragms are molded from standard material, or fabricated from film or sheet. Complicated, more flexible diaphragms use plasticized Kel-F. The plasticized material is produced by using a low molecular weight Kel-F polymer oil as a plasticizer. The finished material retains its chemical inertness, but both high and low temperature resistance limits are somewhat curtailed.

Another type of end product is a Kel-F lined hose produced by Resistoflex. Available in sizes having ¼, ⅜, and ½ in. inside diameters, it is designed for handling such corrosive chemicals as white fuming nitric acid.

Plasticized and Unplasticized

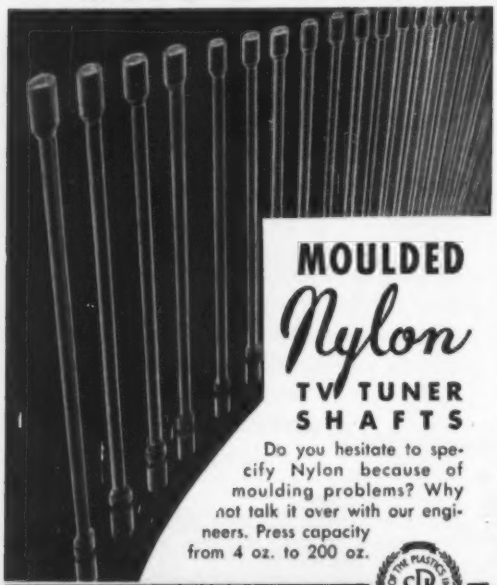
Various types of film and tape are made from Kel-F. Visking is producing a 2 to 10 mil thick flat tubing up to 14 in. wide called Trithene. Type A, which is unplasticized, has a strength of 6300 p.s.i. Type B is plasticized and has a strength of 4000 p.s.i. The material is suggested for thin wall bags, cells and bladders for storing acids, as a flexible membrane in metering diaphragms, and in gaskets, tank linings, electrical insulation, laminations, safety gloves and clothing, and bottle cap liners. Such things as blood, saline solutions, and essential oils could be packed in Trithene without danger of permeation. The material has been successfully laminated to stainless steel and aluminum, to metal screen cloth, to glass cloth, and to canvas belting.

It is believed that the time is not far distant when dispersions will be slushed or sprayed on a highly polished surface in a series of layers that are baked on and the whole then stripped off after the desired thickness is obtained. Such a film will have no pin holes, will be produced from high molecular weight resin without a plasticizer, and will have very good clarity and most any color desired that can be obtained from inorganic pigments. It will be costly, but will have the characteristic high and low temperature resistance of Kel-F and be exceedingly tough. It will be primarily for expensive, unbreakable packaging material for such things as high grade pharmaceuticals.

Kel-F dispersions are also used to impregnate glass cloth which is used for slot and wedge insulation. Sometimes the impregnated cloth is laminated in five layers—other times the glass fabric is sandwiched between Kel-F film. There has not yet been enough of the cloth to get wide distribution in other fields.

Dispersions are also available for use on baking pans as a nonsticking agent; molded parts for dough rollers are used by bakers. Unavailability of material and high cost have held up development in this field for Kel-F.

As with Teflon, one of the biggest



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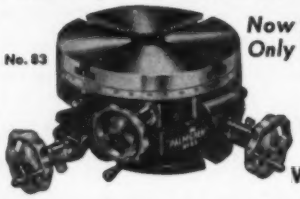

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fields of all for Kel-F applications is that of wire coating.

The remaining portion of this article is devoted to a description of some of the work being done by a few representative companies in the application of fluorocarbon plastics. The record is by no means complete, but enough details are given to indicate possibilities for the future as seen in the commercial successes of today.

Fluorocarbon Uses

U. S. Gasket Co., Camden, N.J., is a real pioneer in the fluorocarbon fabricating business. In fact, the company was set up because of a recognition of fluorocarbons as a superior gasketing material. But the company has gone far beyond gasketing products and expansion joints.

Foremost among the company's products are metal-surfaced fluorocarbon combinations which serve to minimize certain inherent limitations of the fluorocarbons while retaining an adequate degree of their advantages and cutting down their cost through the lower cost fillers. The technique of combining other materials with Teflon consists of thoroughly mixing fine particles of the filler material with Teflon powder before making the preform. One of the most valuable new fields opened up by fluorocarbon combination materials is the production of Multi-Bond (U. S. Gasket patent application) metal surfaced Teflon. This is suitable for hermetic sealing, soldering, or other bonding purposes. The preform is constructed with a base of pure Teflon, over which are several layers of mixtures of fluorocarbon and fine metal powder, with an increasing percentage of metal in layers nearer the surface. The resulting part is then a material which gradually changes from a pure dielectric to a semi-conductor and then to a conductor as the number of metal particles in a given volume increases as they approach the surface. The final product is in the form of either single or double-faced sheets with a choice of most any metallic surface desired.

An even later development in adhesion technique for Teflon is the perfection of a cement seal that is easier to make than a solder seal.

(*Continued on p. 176*)

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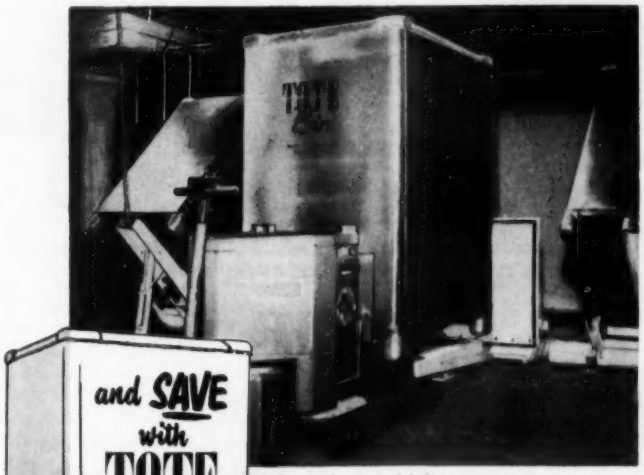

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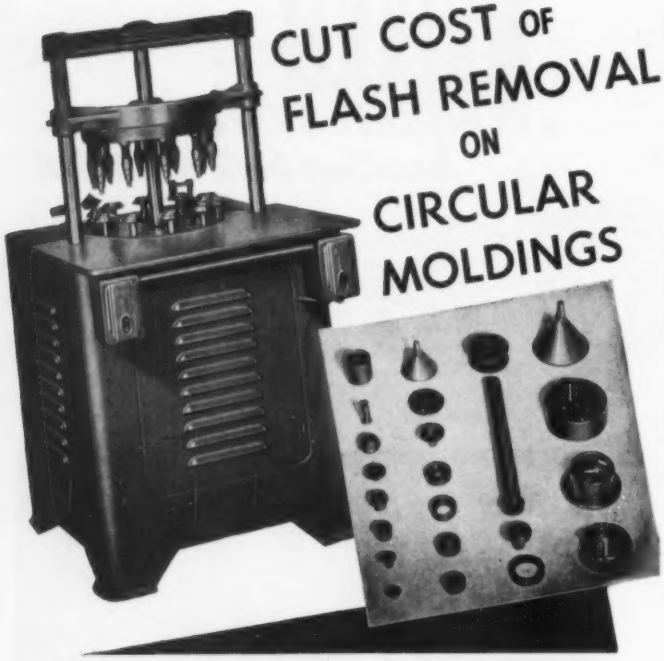

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In this instance, the Teflon surface is simply contaminated with powdered Portland cement and can be adhered to practically anything by using liquid Portland cement as a bonding agent.

U. S. Gasket's Chemelec Teflon tube sockets are designed for use when high or low ambient temperatures or frequency stability are problems. The market for premium type sockets today is between 30 and 40 million a year—most of them employ ceramic or phenolic, but fluorocarbons are creeping up and will compete price-wise with ceramic—one order alone was in the 5-figure realm. There are four outstanding reasons for use of fluorocarbons in this and other electrical equipment:

1. Dielectric constant over a broad frequency range is 2.1, just about the best known. In other words, less electrical energy is dissipated through a fluorocarbon. The material works just as well in flea-power as in high voltage circuits.
2. Dielectric strength is high.
3. No moisture absorption.
4. It does not carbonize from arcing.

Another strong item at U. S. Gasket is Teflon crystal sockets. Crystals are essentially tuners and the Teflon sockets are recommended especially for high frequency circuits, because they give the added factor of resistance to vibration and shock. There will be 20 million crystal sockets of all types made this year. Eventually, nearly all such sockets may be fluorocarbon.

Another standard item is hermetically sealed Teflon transformer terminals. The company has produced one such terminal with 11 parts, including 9 pins, in one molded casting to replace a former piece that had 63 parts and was hand assembled. Needless to say, the Teflon terminal was less costly than the one it replaced.

Another product is Chemelec laminates, made especially for printed circuits. These Teflon-fibrous glass laminates may be bonded to almost any metal by heat and pressure, but for printed circuits they have a copper foil surface with a nominal thickness of 0.003 inches.

U. S. Gasket also carries in stock a complete line of Teflon and Kel-F rods, tubes, and sheet for the bene-

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The Garlock Packing Co., Palmyra N.Y., is producing the following:

A "pickle gun," used by the meat packing industry, which is essentially a spring-loaded valve with a large hollow needle on the outlet side. The needle is inserted in a ham, the valve opened by a trigger arrangement and the "pickle" (tenderizing and curing agents) is "shot" into the ham. For valve stem packing on these guns nothing lasted more than two or three weeks until Teflon rings were used; these give more than one year of service.

In a Maine paper mill braided Teflon rings are being used as an acid valve stem packing in sulfite pump service. After being in service one year, Teflon rings were taken out and inspected and were found to be in such good condition that they were placed right back in service. Previously, these valves were repacked once every three weeks. This comparison holds fairly true on all acid valve stem packings, whether in paper mills or chemical plants.

A manufacturer of colloid mills was unable to obtain a satisfactory seal on the agitator shaft of its mills that handled a combination of oils, paints, and solvents. The mills have an $1\frac{1}{16}$ in. stainless steel shaft that operates at 10,000 r.p.m. in almost continuous service. A Garlock Klozure oil seal with a Teflon sealing element, in place of the usual synthetic rubber sealing element, solved their problem.

Some other end uses on which Teflon has solved the problem and overwhelmingly outlasted other materials are:

Bases for dies that are chrome-plated; packing for pumps handling lacquers, varnishes, thinners, and chemical solvents of all kinds; valve stem packing against ammonia gas at 15,000 p.s.i.; as packing or gasketing for sealing strong acids on valves, pumps, and piping made of porcelain or glass.

The Grinnell Co., Providence, R. I., is distributing Kel-F diaphragms to a chemical plant handling chlorinated solvents; a paper mill to handle chlorine dioxide bleach; a synthetic fiber plant to handle strong acids; a chemical plant to handle ammonium thiocyanate solutions; and to atomic energy plants. Some of the diaphragms have been in service more than two years and are generally used to replace other synthetics which failed because of corrosion. Their use has become widespread purely upon the savings in down-time, repairs, and maintenance, which this material makes possible.

Plax Corp., Hartford, Conn., produces Kel-F rod, sheet, and tube in stock sizes, but also does custom molding and extrusion. Gaskets are fabricated from $\frac{1}{32}$ to $\frac{1}{4}$ in. thick molded sheets. All rods above $\frac{5}{8}$ in. diameter are molded—largest sizes now available are 3 in. diameter and 2 ft. long. Their molded sheet is available in $\frac{1}{64}$ to $\frac{1}{4}$ in. thick disks up to $18\frac{1}{2}$ in. diameter.

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National Engineering Products, New York, N.Y., is producing Templube #56, a paste-like, anti-seize compound based upon a combination of fluorinated hydrocarbons which have outstanding resistance to oxidation. It is designed for sealing threaded and gasketed joints in oxygen handling equipment where high pressures and high temperature are involved.

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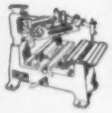

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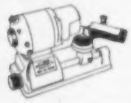

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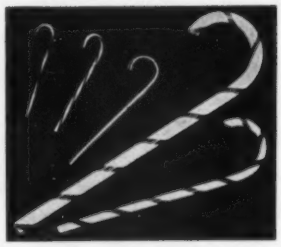

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Biaxial

(*Continued from pp.* 117-24)

concept the mechanism suggested above for stress-crazing may be modified to include the influence of solvents as follows. The solvent molecules penetrating the surface of the polymer tend to surround portions of the polymer chains and reduce the forces required to separate them. Because of this weakening influence of the solvent molecules, at a surface flaw such as a region of normal orientation of the polymer chains, the stress concentration that can be withstood is reduced and a tiny crack develops at a lower applied stress than in the absence of solvent. The solvent molecules by capillarity probably fill the crack as it grows and continue to exert a weakening influence at the apex. It has been suggested by Hopkins, Baker, and Howard (8) that another weakening influence at the apex of a crack is the film spreading pressure of the crazing liquid.

The effect of forming on stress-solvent crazing might be expected to be similar to that for stress-crazing. The reduction in the number and size of the regions of normal orientation and increase in the regions of parallel orientation should result in higher threshold stresses for the formed material. Also, for formed material as for unformed, the crazing stress should be lower in the presence of, than in the absence of, solvent, owing to the weakening influence of the solvent.

Accelerated Weathering Tests

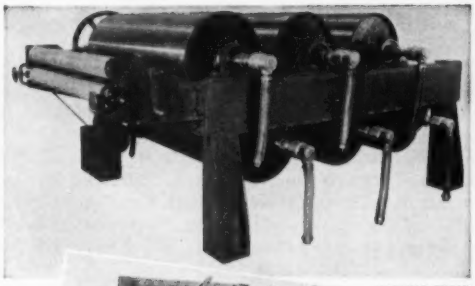
The light transmission values for all the materials, both unformed and formed, are $92.0 \pm 0.1\%$ initially and $92.3 \pm 0.3\%$ after weathering. While the transmission values are slightly higher after weathering, the individual differences, which do not exceed 0.5%, are considered within the experimental error of measurements made at different times. The haze values are approximately $0.5 \pm 0.2\%$ for all materials both formed and unformed and before and after weathering. In this connection, the specimens were inspected visually after the weathering test but no crazing was observed on any of them.

For all samples the shrinkage of the unformed or control specimens was very slight, averaging 0.05 to 0.1%, which values are of the order of magnitude of the standard error of the shrinkage values. The formed specimens of the heat-resistant grade samples shrank only 0.2%; however, similar specimens of the general-purpose grade samples shrank somewhat more, the values being 1 and 2% for Plexiglas I-A and Lucite HC201, respectively.

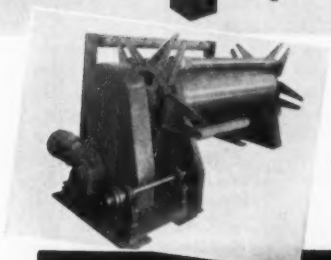
Most of the specimens were slightly warped after the weathering test. In general the formed specimens were more warped than the unformed, particularly for the general-purpose grade materials.

The greater dimensional changes for formed pieces of the general-purpose grade samples as compared to the heat-resistant grade are not surprising for the following reason. The specimen temperature in the test is about $60 \pm 5°$ C. which is not far below the values obtained for the second-order transition temperature of the general-purpose grade samples, namely, 75° to 80° C.; the corresponding temperature for the heat-resistant grade is about 94° to 95° C.

The improvement in the crazing



COOLING TRAIN



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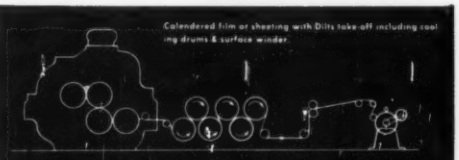

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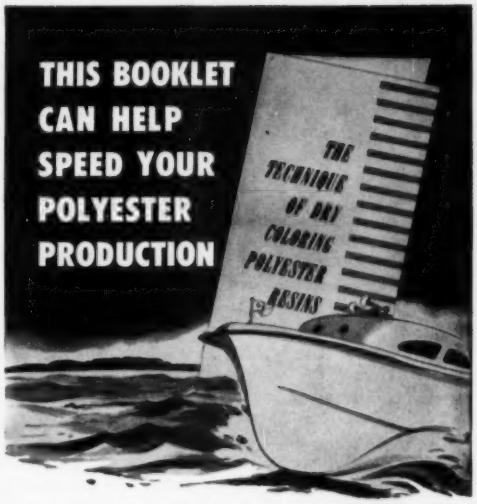

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properties of acrylic plastic sheet produced by moderate (50%) biaxial stretch-forming suggests that formed enclosures made from prestretched flat sheets may have superior crazing and strength properties compared to enclosures formed from normal sheets. In an astrodome as prepared normally, as for example by vacuum drawing, there is a maximum amount of stretch and craze resistance at the apex and negligible stretch and minimum craze resistance at the rim. The use of prestretched sheet would hence improve the craze resistance, especially at the rim where prolonged contact with crazing agents is quite likely.

As an alternative to using prestretched material to achieve improved craze resistance at the edge of acrylic enclosures, there is the possibility of preparing an enclosure larger and more deeply drawn than required and then using only the central portion of the formed piece.

In view of the considerable changes in the physical properties of cast polymethyl methacrylate sheet resulting from biaxial stretching to about 50%, it is of interest for both practical and fundamental reasons to learn the effects of greater stretching on this material. Experiments with this objective are in progress on material stretched up to about 150%. The effects of biaxial stretching on other physical properties such as creep, abrasion resistance, natural weathering while under load, impact resistance, fracture under bullet impact, and crazing with various solvents should also be determined.

Acknowledgment

This investigation was conducted under the sponsorship of the National Advisory Committee for Aeronautics; this report is a condensation of N.A.C.A. Technical Note No. TN 2779. The courtesy of E. I. du Pont de Nemours and Co. and the Rohm and Haas Co. in furnishing materials for use in this investigation is gratefully acknowledged. The advice and assistance of the following persons is also appreciated: Messrs. W. F. Bartoe, R. E. Leary, W. Koch, John Mandel, M. N. Geib, and A. M. Pennington.

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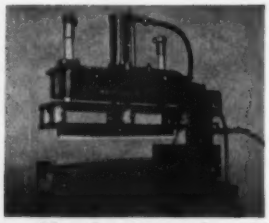

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Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid-tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,437,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Germany Patent 829,248 September 25th, 1949. Great Britain Patent 662,219 September 27th, 1949. Argentina Patent 96,970 September 30th, 1949. Brazil Patent 39,676 December 29th, 1951. Mexico Patent 51,615 January 3rd, 1952. Other U. S. and Foreign Patents Pending.

TUPPER / Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

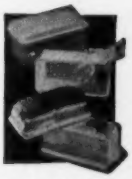
Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Por Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

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Here's the answer to a major molding problem . . . a small machine with big ideas! The **LEWIS "4"** is the only small size injection molding machine that can do the work of an 8-ounce model on lightweight jobs having large projected areas.

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For production speed and economy in one compact package, specify the LEWIS "4".

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Fluorothene

(*Continued from pp.* 126-30)

the extrusion operation to minimize undesirable effects arising from one or more of the following factors: 1) viscosity breakdown of the resin; 2) roughness caused by improper die design; 3) non-uniformity due to surging or pulsation in the screw. Of these, viscosity breakdown is the most important. A proper balance must be maintained between conducted and frictional heat at all times so that the resin is not subjected to excessive thermal abuse at any stage in the process. In some machines, particularly if the screw temperature is not controlled, cylinder and head temperatures in excess of 600° F. are required to achieve the proper resin plasticity at the die. If the screw is controlled, as noted above, at 300° to 350° F., more frictional heat is generated, reducing the requirement for heat conduction from the cylinder, and permitting operation at cylinder temperatures, in some instances, as low as 450° F. The temperature of the resin leaving the cylinder may be the same in the two methods of operation and there is no conclusive evidence, at the present stage of the art, to indicate that either method is preferable to the other.

Cooling the Throat

The throat section of most plastic extruders is jacketed in some manner for liquid cooling. Cold water circulation has proved too radical in most instances, tending to cause packing of granular material in the rear threads of the screw. Low pressure steam has been found satisfactory, but it is believed that control of the throat at some temperature between 77° and 212° F. by means of circulating hot water or other liquid, might be more effective in providing maximum thrust by the screw. In some cases, satisfactory results have been obtained by allowing the throat section to "float" without any circulating coolant, although this may lead eventually to bridging difficulties in the hopper.

Screens can be used between the end of the screw nose and the breaker plate but are not always necessary. They appear to be useful with resins pigmented by cold tumbling methods, in reducing roughness caused by poor

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Take a look at the complete picture of K & J service from engineering and mold making to molding and finishing. You'll find us a wholly integrated organization, independent of outside sources, except for materials—a factor which contributes to custom molded plastics at low cost. You have the call on our skill, experience and facilities which help you get maximum value from every dollar invested. We'll be glad to show you how K & J service works to your advantage. Consult one of our representatives or write us direct.

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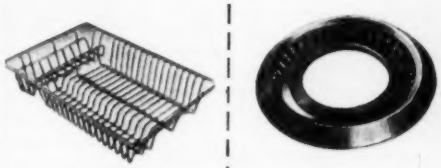
VINYL PLASTISOLS



MICCROSOL, a product of Michigan Chrome & Chemical Company, is a true vinyl plastisol which can be readily adapted, through special formulation, to meet the strictest requirements for: dipping, casting, slush molding, etc.

We will be pleased to submit a sample of one of our many proven coatings, or engineer a vinyl plastisol for your product.

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We recently expanded our facilities for the production of fiber glass reinforced plastic flat sheet.

The improved efficiency obtained from this increased production plus our ability to buy raw materials in the largest quantities at lower prices allows us to offer reduced prices to large users of fiber glass mat reinforced polyester flat sheet in thicknesses from .040" to .50". Sheets are available in sizes of 36" x 72."

Lower Costs Open Up New Fields

Fiber glass reinforced plastic has unlimited applications where the finished product requires exceptional strength, light weight, dimensional stability, moisture and corrosion resistance, excellent electrical and insulating qualities.

Previously, the main disadvantage was the high cost. Now, with lower costs, fiber glass reinforced flat sheet offers you a cheaper, yet better, finished product.

Large Volume Users Wanted

If you have a potential use for fiber glass reinforced plastics in large quantities we'll be glad to help you analyze your problems.

Write for samples

We'll be glad to send samples so that you can examine the high quality of M. R. F. fiber glass reinforced plastics.

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pigment dispersion. Screens as fine as 120 mesh have been used for this purpose without apparent effect on resin degradation. Other methods of restricting material flow at the end of the screw have also been effective. One such device is a single hole breaker die, ⅜ to ½ in. in diameter and about 1 in. in length, with a tapered entrance parallel to the surface of a pointed screw nose, the clearance between the screw nose and the die being controlled by longitudinal adjustment of the screw in the cylinder.

Die Design

Interest in Fluorothene for wire coating purposes started, logically, in the small diameter, thin wall field, which includes radio, aircraft, and telemetering wires for high temperature applications. It soon became apparent that extrusion techniques normally used for coating such wires with vinyl plastic compounds or polyethylene could not be employed with Fluorothene due to excessive viscosity breakdown. This was caused by the restrictive effect of small area dies and the high resin temperatures necessary to force material through the dies with the available pressure developed by the screw. Fortunately, it was found that Fluorothene, similarly to nylon, could be readily hot stretched at its extrusion temperature without introducing excessive strain. It is possible, therefore, to increase the die size appreciably, extrude an oversize tube, and pull it down onto the wire as it leaves the die, assisted, if necessary, by a vacuum on the guider pin. In this manner viscosity degradation is greatly reduced, centering problems are essentially eliminated, and coating speeds materially increased.

Tubing dies and guiders with flat land lengths of 0.5 to 3 in. are ordinarily used in the draw-down method to prevent roughness on the inner and outer surfaces of the extruded tubing. The actual land length is not critical and will depend to some extent on the resin velocity through the die. In general, the shorter the land length or the greater the extrusion speed, the higher the die and guider temperatures necessary to prevent roughness. One difficulty often encountered is attributable to the fact that the guider pin is heated only by conduction from the crosshead proper and may actually be

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FILM EXTRUSION. Technical paper discusses the extrusion of vinyl, polyethylene and other plastic films through various types of extrusion dies. Compares costs and yields of extruders versus calenders. Naugatuck Chemical Div., U. S. Rubber Co. **(L-202)**

LIQUID PHENOLIC RESINS. Catalog describes custom-compounded Marblette liquid phenolic resins for a wide range of unusual coating, bonding, casting and sealing applications involving plastics, metals and non-metals. The Marblette Corp. **(L-216)**

ANNEALING MOLDED "PLEXIGLAS." Explanation of why crazing occurs in molded "Plexiglas" parts and details on how annealing can prevent crazing from occurring. Rohm & Haas Co. **(L-224)**

DRY POLYESTER RESINS. Booklet describes three basic resins used by the reinforced plastics industry for low pressure lamination or coating of "Fiberglas," paper, or similar materials and as a component of industrial laminates. Atlas Powder Co. **(L-230)**

PRINTING MACHINES. Catalog describes various hand-operated, semi-automatic, and automatic machines for printing, decorating, etching, gold stamping, roller coating, and dipping plastic items of all kinds. Apex Machine Mfg. Co. **(L-242)**

Any of the booklets described here plus many others—forty-four in all—are available for the asking, without charge or obligation.

Just turn to the Manufacturers' Literature page in this issue (it's printed on heavy colored paper), circle the numbers corresponding to the booklets you want, fill in the reply postcard, and mail. No postage needed.

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ATLAS FADE-OMETERS AND WEATHER-OMETERS

. . . playing an important part in improving the quality of **PLASTIC PRODUCTS . . .**

The destructive effects of sunlight on plastic products such as hardening, loss of flexibility, cracking, change in color, etc., can be determined with speed and accuracy in the Atlas Fade-Ometer.

In making tests, samples are rotated in holders around the Atlas Enclosed Violet Arc—the closest approach to natural sunlight—with temperature and humidity regulated according to requirements of test. Holders are available for three sizes of samples, 2½" x 4¾" capacity 42 samples, 2½" x 8" capacity 21 samples, 6¼" x 10" capacity 9 samples. Tests can be duplicated at any time thus providing reliable data in product development work.

Operation is completely automatic and the Fade-Ometer can safely be left running continuously for 24 hours without attention. A few hours or days testing in the Fade-Ometer equals months or years of exposure to actual sunlight.

Fade-Ometer tests are fast becoming accepted as a yardstick for standardization in the plastic field as they have been in the textile, paint and other industrial fields for over twenty-five years.

The Atlas Twin Arc Weather-Ometer is used to duplicate the combined weathering effect of sunlight, rain, heavy dew, and thermal shock for plastic products exposed to outdoor use. Like the Fade-Ometer it is completely automatic in all operations. The cycle timer can be set for duplicate tests at any time.

Write for further information in relation to your problem for testing plastic materials.

ATLAS ELECTRIC DEVICES CO.

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cooled by the resin flowing over it, resulting in roughness on the inside of the extruded tubing. If the temperature of the head is raised sufficiently to overcome this condition, excessive viscosity degradation is likely to occur in the head. It is also possible to raise the front cylinder temperature until the resin entering the head is at a higher temperature than the head itself, in which case the temperature of the guider pin is increased by the resin flowing over it and inside roughness is eliminated. This is also likely to result in excessive viscosity degradation, this time in the cylinder.

In both cases, the resin leaving the die is at a higher temperature than necessary for satisfactory drawdown onto wire. A unique solution to this problem is accomplished by making the guider sufficiently large to insert a resistance wire heater wrapped around glass or other insulated tubing as illustrated in Fig. 4. It is then possible to heat the guider independently, permitting operation at lower cylinder and head temperatures, with consequent reductions in the resin temperature and the degree of viscosity breakdown. With this method, using a 1.5 in. electrically heated extruder and a "metering" type, oil-cooled screw, it has been possible to extrude CF3-15 resin at rear and front cylinder temperatures of 450° F., a head temperature of 500° F., the die at 520° F., and an extruded resin temperature of 550° F., drawing down from a 0.700 in. diameter die to a final diameter of 0.075 in. (10-mil wall) on No. 16 stranded wire. Final resin viscosities of 3.5 to 4.5 megapoises at 446° F. were obtained, compared to values of 1.0 to 2.0 megapoises normally experienced when a heated guider pin is not employed.

Properties and Applications

The principal advantages of Fluorothene wire insulation over conventional materials are its chemical, water, weathering, cutting, and flame resistance, high insulation resistance, and the retention of these properties over a wide temperature range from as low as −75° F. to well over 212° F. An exact upper temperature limit has not been established in actual practice and will vary for different applications. As previously mentioned, the upper temperature limit may be determined by the effect of

Greetings:

from the City of Brotherly Love.

On October 15, 1952, was completed the transfer of the color-dispersing facilities of Acheson Colloids Company, Port Huron, Mich., to the plant of its affiliate, Peerless Printing Ink Company at Philadelphia. All pigment dispersions formerly sold under Acheson's well-known **'dag'** trade-mark, as well as the paste dispersions previously marketed under Peerless' own label, will henceforth be identified as

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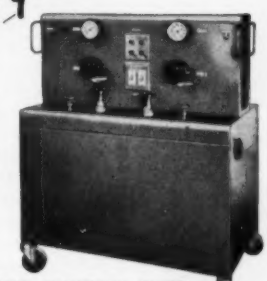

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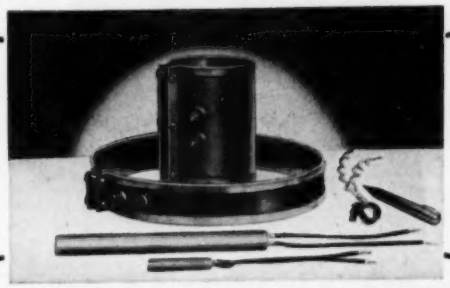

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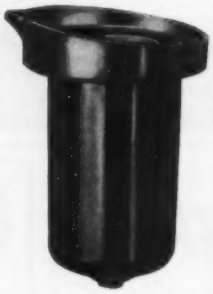

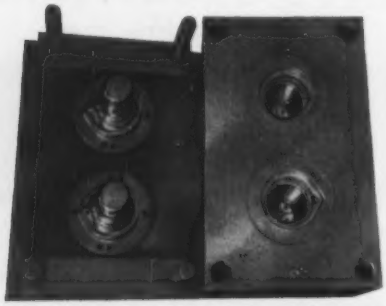

Every liner must fit snugly. Every finished plastic part must *pop-out* of the mold smooth, perfect and ready for assembly. Only by such quality control are great names like "UNIVERSAL" maintained.

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PLASTIC MOLD DIVISION
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crystallization during heat aging, leading to embrittlement and failure under voltage stress. If severe bending or flexing is required during or after prolonged exposure to high temperatures, the present limit appears to be on the order of 265° F. In permanent installations where flexibility after heat aging is not required, a somewhat higher operating temperature may be possible. The seriousness of the crystallization effect is reduced if a molecular weight equivalent to a melt viscosity of 2.0 to 3.0 megapoises or higher is maintained in the finished product; it has been shown that this is practicable by proper control of extrusion variables.

The mechanism by which the dielectric strength is reduced during heat aging is not thoroughly understood and is the subject of extensive laboratory investigation. Breakdown paths along crystal interfaces are postulated, and it is believed that new or shorter paths may be caused by crystallite and spherulite formation during heat aging. Several methods of altering the basic crystal growth mechanism are under study, from which it is expected that a further increase in the upper service temperature limit will be accomplished.

Insulation resistance values in excess of 30,000 megohm-1000 feet at 30° C. and 10,000 megohm-1000 feet at 90° C. have been reported for samples of No. 22 radio hookup wire with a 7-mil coating of Fluorothene. Volume resistivity values over 10^{14} ohm-centimeters have been obtained at 200° C. on molded sheets. Surface insulation resistance is for all practical purposes infinite, even under conditions where high relative humidity is encountered.

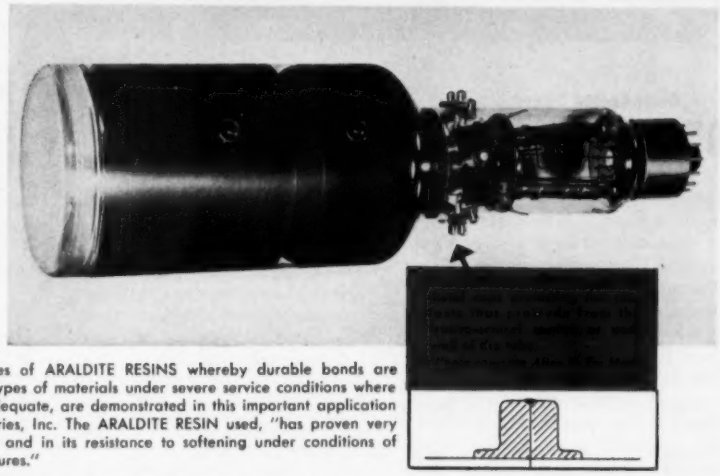
Immersion in such materials as battery acids, lubricating oils, gasoline, and acetone has been shown to have no significant effect on the mechanical or electrical properties of Fluorothene insulated wires. Excellent resistance to highly corrosive fuels and their reaction products has also been reported.

The above properties of Fluorothene insulated wires together with resistance to inadvertent damage during soldering operations in close quarters, reduced size, and ease of handling have proved of real advantage in many radio telemetering, and other electronic equipment applications.—END

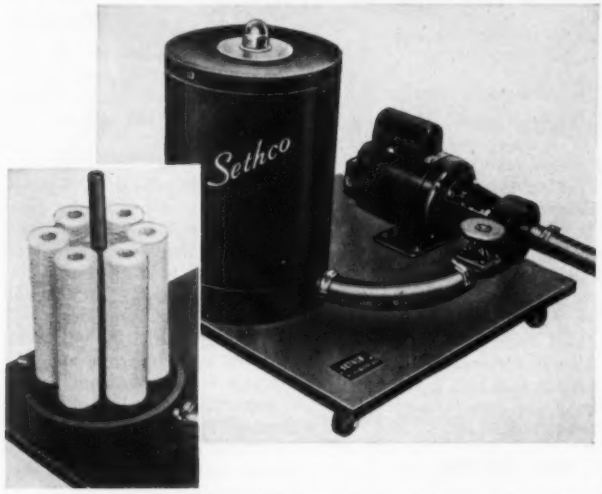
IDEAS *in the making*

Araldite Bonding and Casting Resins developed by Ciba Research are simplifying manufacturing methods, improving product efficiency, and opening new fields of product development. You will want to know more about them.*

DURABLE . . . HIGH TEMPERATURE RESISTANT METAL-TO-GLASS BOND ON CONTACT LEADS ON DUAL-BEAM CATHODE RAY TUBE



The exceptional bonding properties of ARALDITE RESINS whereby durable bonds are achieved between many different types of materials under severe service conditions where other bonding materials prove inadequate, are demonstrated in this important application by the Allen B. Du Mont Laboratories, Inc. The ARALDITE RESIN used, "has proven very satisfactory in its bonding strength and in its resistance to softening under conditions of high humidity at elevated temperatures."



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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Glass-Coated Screen Cloth

OVER 60,000 lb. of vinyl plastisol-coated, silicone-treated glass yarn has been made into screen cloth and put into service, according to William J. Harrison, manager of Chemo-Textiles, Inc., W. Warwick, R.I., producer of the coated filament. The screen cloth was woven by Plastic Woven Products Co., Paterson, N.J., and Gaunt Textiles, Inc., W. Warwick, R.I. Others said to be experimenting with the material are Chicopee Mfg. Corp. of Georgia, 40 Worth St., and St. George Textile Corp., 119 W. 40 St., both New York, N.Y.

The outstanding properties of this new plastic screen cloth are resistance to shrinkage, stretching, and sagging. It is dimensionally stable in all directions, it is fireproof, and is being tested by Army engineers throughout the world to prove that it will stand up under all kinds of climatic conditions. It is claimed to be the most easily handled screen cloth yet developed for fastening to a frame by either amateur or professional. The cost is a little less than that of bronze wire.

Mr. Harrison states that this material is being evaluated for woven automobile seat covers and also recommends it for tobacco cloth. He says that it will cost three times as much as cheese cloth, the material now widely used for tobacco protection, but will last for several years because of its weather resistance and its ability to withstand hailstorms.

The company is also experimenting with the material as an embedment in vinyl sheet. In such form it could be used for tents, swimming pool liners, and as a replacement for canvas and tarpaulins. It is also suggested as a layer under concrete floors for moisture sealing. Other suggestions are as a covering for canoes to replace canvas; for light luggage; and for conveyor belts where it would eliminate stretching problems.

The vinyl-coated glass yarn is also being experimented with as a reinforcement in plastic pipe winding—the idea is much the same as that applied in braided hose. It can also be used to serve on wire for the electrical industry, and in this case, the strands can be fused to themselves, thus eliminating the need for lacquer.

Another product of Chemo-Textiles is an impregnated cotton yarn which is resistant to oil, water, and chemicals, and which is useful for industrial seals. The material is being evaluated for use in brake-control cables for automobiles and aircraft.

*Reg. U.S. Pat. Off.

Acrylic Lenses for Eyes

SMALL acrylic lenses are being used in human eyes to replace the eye lenses lost through cataracts, according to reports from a recent meeting of the International College of Surgeons.

Cataracts are a cloudiness over the eye lenses which often blinds the victim. The eye surgeon removes the clouded lens and substitutes a small disk of acrylic, which almost floats in the eye. The patient does not feel it. It is held in place by a membrane and does the same job as the former human lens.

Wider Fiber Mat

A RANDOM fiber mat, or "non-woven fabric," bonded together with resins that are compatible with vinyl plastics, Lantuck is now being produced in 55- and 56-in. widths as well as in its original 38- and 40-in. widths. Lantuck, developed by Wellington Sears Co., 65 Worth St., New York, N.Y., and West Point Mfg. Co., is a patented textile fiber mat containing suitable binders which impart equal strength and pliability in all directions. It is being manufactured in weights ranging from approximately 1½ to 7 oz. per sq. yard. Its first application about three years ago was in the narrow widths for lamination of gears, cams, bobbins, bearings, washers, and other mechanical parts in the high-pressure laminating industry.

Production of the wider widths is for application as backing for certain types of artificial leather upholstery materials which have the advantages of both supported and unsupported film, without the disadvantages of either. They have the soft "hand" of unsupported film without danger of tearing and cracking; they help eliminate the need in supported fabric for thick coating to cover weave without the handicaps of high cost and stiffness.

Bobbins for Fibrous Glass

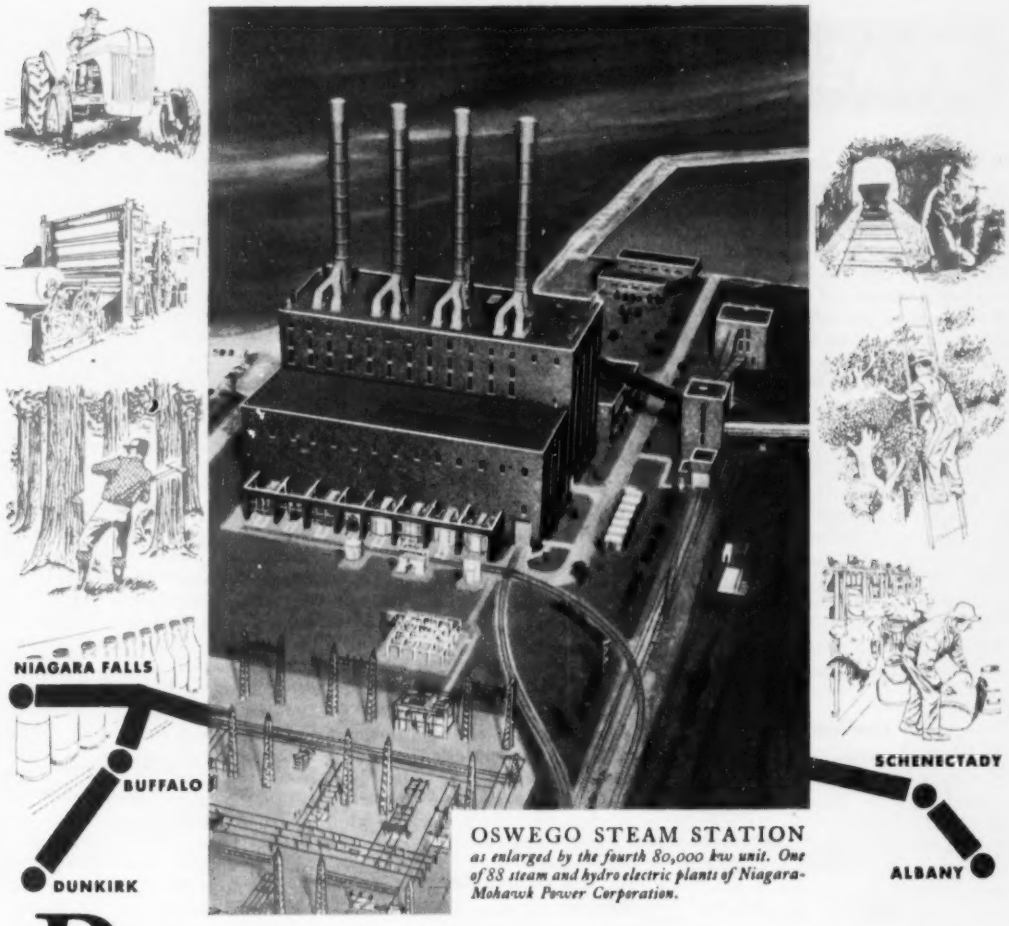
BOBBINS of a special grade of Continental-Diamond Fibre Co.'s Dilecto (a laminated paper-based thermosetting plastic) have been developed for winding glass fibers. Light tan in color, grade XX-80 tubing has been processed to resist heat, moisture, and chemicals. It is supplied with a ±0.005 in. tolerance on the internal diameter. Bobbin bodies made from this new material possess higher mechanical strength than standard XX roll tubing.

Plastics in Refrigerators

MORE than 80 million lb. of plastics were consumed in the construction of over 4 million electric refrigerators in the United States in 1951, according to a spokesman for Admiral Corp. He said that Admiral refrigerators utilized an average of 20 to 22 lb. of plastics per unit, with one model using approximately 31 lb., which is equivalent to nearly one-tenth the total weight of the refrigerator. The largest plastic part of this model is the inner door liner which measures 43½ by 28 in. and has a projected area of 1240 sq. inches. It weighs 7½ lb. and is claimed to be the largest injection molded plastic part yet produced. It is produced in one piece from a mold that weighs five and a half tons and cost more than $25,000.

Phenolic Analysis

CHEMICAL composition of phenolic plastics can be determined by a new analytic technique from Westinghouse Electric Corp.'s Research Laboratories. The "blotter,"



OSWEGO STEAM STATION
as enlarged by the fourth 80,000 kw unit. One of 88 steam and hydro electric plants of Niagara-Mohawk Power Corporation.

PRIVATE ENTERPRISE *In Action*...

The Niagara-Mohawk Power Corporation has 7000 circuit-miles of transmission lines and 85,000 conductor-miles of distribution lines in upper New York state. Its entire system has a rated capacity of 2,186,451 kw with 600,000 kw now under construction.

A current example of their enterprise is the Oswego Steam station, designed by their engineering department with construction supervision by Stone & Webster Engineering Corporation.

The benefits of competent business management of a privately-owned utility are again demonstrated by the Niagara-Mohawk system.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.

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or paper chromatography, technique is applied in the following manner: A strip of white blotter-like paper treated with an "indicator" chemical is suspended in a large glass jar about two feet high. Pin-point samples of known and unknown ingredients of a phenolic are placed at intervals along the top of the paper. The top of the strip is held in a glass trough filled with a solvent capable of dissolving the samples. A small dish of the same solvent is kept in the bottom of the jar to keep the air inside saturated.

The solvent begins to "run" down the paper, carrying the ingredient samples with it. After 15 or 16 hr., the leading edge of the solvent approaches the bottom of the paper, leaving a trail of colored spots where the solvent has reacted with the indicator chemical. Position of the spots on the paper identifies the ingredient.

Abrasives

A NEW production technique installed at Carborundum Co.'s Coated Products Div. plant in Niagara Falls, N.Y., will set new standards of precision in the manufacture of coated abrasives, according to company spokesmen. It is estimated that well over 10 million lb. of phenolic resin are used annually in the manufacture of coated abrasives. With the new production setup, Carborundum can control thickness and density of the adhesive and abrasive coat with an accuracy within 1 percent.

An additional advantage is that coated-abrasive users can at any time get a precise duplication of a previous order, since Carborundum keeps a complete production record of every roll produced. At present most abrasive materials in the form of sandpaper rolls, disks, belts, and pads, come in various degrees of thickness and density of abrasive, resin coats, or backing. The new Carborundum technique controls these variations so that a customer may expect low tolerances.

The new technique worked out with specialists of the Industrial Nucleonics Corp., Columbus, Ohio, integrates five Accuray beta-ray gages, actuated by radioactive isotopes, into the coated-abrasive machine production line. The five gages continuously assess weight of backing, weight of adhesive, weight of abrasive, weight after pre-cure, and weight after final adhesive application on a line that travels at a speed as high as 350 ft. per minute.

Glass Pipe

A FIBROUS glass-reinforced thermosetting plastic pipe for pressure transmission uses has been developed and placed on the market by Reflin Co., Gardena, Calif. The pipe is unaffected by electrolytic corrosion, and the operating temperature range is from —90 to 230° F. Using standard fittings and simple tools, Reflin pipe, with completely leakproof joints, can be laid by two men under average terrain conditions. Connections are made by sleeve-type couplers, "Resin-Wrap" joints, quick couplers, and other methods readily handled in the field. The pipe is reported to be adaptable to all standard auxiliary equipment in standard sizes of 4, 6, 8, and 10 in. O.D., in 20-ft. lengths.

New England Plastics

THE Federal Reserve Bank of Boston has published a comprehensive survey of the industrial outlook for New England. Much of the research was done by A. D. Little Co., 30 Memorial Drive, Cambridge 42, Mass. The report states the following about New England's position in the plastics industry:

"New England is today the foremost section of the country for plastics fabrication, accounting for one-third of the national output. The availability of skilled die workers to manufacture molds, and accessibility to large markets, make New England a natural location for the industry. Although the New England plastics industry grew at a rate greater than that of the country as a whole during the last decade, the industry cannot be expected to continue indefinitely to grow at the rate experienced in the past. It is probable that New England will share in the growing manufacture of new plastic products, such as those reinforced with Fiberglas."

Decorative Laminate

DEVELOPMENT of a high pressure decorative laminate, ¼ in. thick, which needs no plywood backing, has been announced by The Richardson Co., 2760 Lake St., Melrose Park, Ill. The laminate is molded in one piece to a phenolic-wood core. Developed for use as a surfacing material for furniture, the ¼-in. sheet is simply glued to a wooden frame, to which table legs and edging are fastened. It is claimed to be lower in cost than conventional laminate-plywood combinations.

Blades for Cooling-Tower Fans

A LIQUID plastic coating called Aeroloid, which dries quickly to a smooth, satin finish resistant to moisture, abrasion, fire, and corrosion is being used to make better blades for industrial cooling-tower fans. Developed jointly by Metal Products Div., Koppers, Inc., and Tennessee Eastman Co., the plastic coating has been adopted for use on all sizes of Aeromaster industrial fans made by Koppers, which range from 4 to 20 ft. in diameter.

The new plastic coating has an acetate-butyrate base with certain added chemicals which give it resistance to combustion. These also add to the toughness of the coating and enhance quick drying and ease of application.

Saran Yarns

EXTRUSION of saran monofilaments is now on a full production basis at Bolta-Saran, Inc., Lawrence, Mass.

The plastic yarn is being offered in diameters of 0.008, 0.010, 0.012, 0.0145, 0.019, and 0.030 inch. Heavier sizes can be obtained on order. Flat, oval Bolta-Saran yarns are offered in the following thicknesses and widths: 0.013 by 0.030 in.; 0.007 by 0.020 in.; and 0.005 by 0.020 inch.

The plastic yarn 0.013 by 0.030 in. is used to make webbing for metal outdoor furniture and wooden indoor furniture. Size 0.007 by 0.020 in. is also used in the furniture field, as well as for auto seat covers and Venetian blind cord coverings. The material in this size is priced

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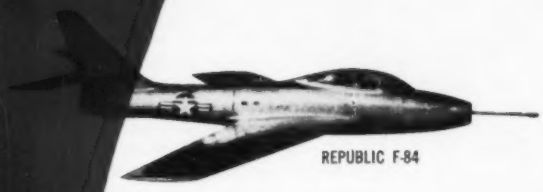

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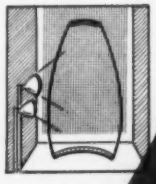
Perfection in Optical Qualities

has made SWEDLOW transparent acrylic canopies virtually the standard of the aircraft industry. Fifteen years of specialization in the fabricating of transparent plastics, plus exacting inspection requirements, have gained for SWEDLOW the complete confidence of the aircraft industry. A few of the outstanding applications of SWEDLOW-made acrylics to aircraft are shown above. We shall be glad to assign staff engineers to work with you on your specific requirements in fabricated acrylics.



LOS ANGELES, CALIFORNIA • YOUNGSTOWN, OHIO

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at 90¢ per pound. The 0.005 by 0.020 in. size is finding uses in woven Venetian blind tape, zipper tape, and drapery and furniture slip cover materials. It is priced at $1.00 per pound.

Polyethylene Carboys

APPROVED by the Interstate Commerce Commission is a polyethylene carboy as a safe package for hydrofluoric acid of not over 60% strength. Also, specification ICC-1F has been issued covering the polyethylene carboy for other suitable chemicals.

Plax Corp., W. Hartford, Conn., blow molds 6½- and 13-gal. plastic bottles which are assembled with outer plywood jackets into the complete ICC-1F carboy units by the Seymour & Peck Div., Grief Bros. Cooperage Co., Rahway, N. J.

Fabric Filler

SHEARED cuttings from pile fabrics of nylon, Dynel, Acrilan, and Vicara are now available in large quantity from Borg Fabric Div., The George W. Borg Corp., Delavan, Wis. Borg officials are of the opinion that many of these fiber cuttings could be used in the non-woven fabric or fiber fields, or possibly as fillers in some types of plastics.

"Things Look Good"

PROFITS of $48,683 for the company's first quarter ending June 30, 1952 as compared to profits of $5656 for the corresponding period in 1951 made things look good for Modglin Co., Inc., Los Angeles, Calif., according to William N. Modglin, president.

Gross sales for the first quarter of 1952 were $638,223 and comparative sales in 1951, $400,187.

Mr. Modglin says that he expects even more plastics product sales for the balance of 1952.

High Impact Phenolic

DEVELOPMENT of a phenolic molding compound, RX-431, with a minimum impact strength of 1.05 lb. per in. of notch that can be automatically preformed, has been announced by Rogers Corp., Manchester, Conn. It is designed to meet the materials requirements of Military Specifications MIL-P-14B.

RX-431, available in black and natural colors, can be automatically preformed on a standard tabletting machine. Preforms can be held to close tolerances. The high strength material can be compression, transfer, or plunger-molded.

The low bulk of the material, approximately 3.5:1, and uniform pellet size make possible precise volumetric loading and permit use of relatively shallow molds, two advantages that reduce cost of producing large molded parts.

Corrosion-Resistant Tank Liners

CORROSION-resistant tank liners made of Agilene (polyethylene) and Agilide (unplasticized polyvinyl chloride) are now offered by the American Agile Corp., P. O. Box 168, Bedford, Ohio.

The tank liners, which are of fully welded construction, are made to customer's specifications. They can be furnished complete with drain and overflows, including Agilene or Agilide pipe flanges, and fittings and valves—permitting incorporation into existing pipe lines and installations.

Agilene and Agilide tank liners in all sizes and shapes, with wall thicknesses up to 1 in., are fabricated at the company's plant in Maple Heights, Ohio. They can also be fabricated on the site of final installation, depending upon the complexity and size of the particular tank liner.

Cancer Research

INTERESTING suggestions on the use of plastics in the treatment of cancer are offered by E. W. Penton, a consulting engineer of Ardsley, Pa.

If a plastic compound could be discovered, suggests Mr. Penton, which could be injected into a body area having malignant cells, and that would "cure" or "jell" in place without migrating, it might serve the following purposes and would have to meet the following conditions:

It might be used as a vehicle to carry radioactive isotopes of a calculated level of intensity and life, and keep them in intimate contact with the affected tissue.

The plastic compound might be used as a vehicle to carry metallic salts which could be activated from an outside source of radiation and maintain radioactivity in close contact with the affected area.

In some areas, a product might be necessary which would have sufficient flexibility and ductility so as not to prevent the functioning of certain non-impregnated elements like arteries, nerve cords, etc. In other areas, a complete blocking of function might be permissible, equivalent to a localized embalming of the area.

In every case, injection and subsequent hardening or fixation of the material must be such as to prevent travel beyond the calculated and controllable area mapped out.

It must be non-irritating to adjacent area of non-impregnated healthy tissue.

Standard White Polystyrene

THE plastics industry in cooperation with refrigerator manufacturers have selected a shade of white that will be considered standard for the production of refrigerator parts made of polystyrene plastics, according to the Commodity Standards Div. of the U. S. Dept. of Commerce. The selection has the endorsement of a standing committee of the industry representing all interests.

The new standard white becomes one of 19 standard colors covered by the Commercial Standard for Colors for Polystyrene Plastics, CS156-49. That standard was established in 1949, and now includes three standard shades of white, as well as standard shades of green, pink, yellow, blue, brown, red, and black.

The publication containing colorimetric data and other information on those colors may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C., for 5¢ per copy.

Synthetic Bristle Plant

MANUFACTURING facilities for the production of the tapered synthetic brush filament, Neoceta, to double present capacity, have been announced by Pittsburgh Plate Glass Co. The shifting and expensive China bristle market and the vari-

Black Beautiful

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CALCO NIGROSINE BASE Z-1630

. . . excellent dispersion

. . . low electrical conductivity

In phenolic type plastics, CALCO NIGROSINE BASE Z-1630 produces intense black shades economically. Its negligible effect on electrical conductivity makes it especially suitable for coloring phenolic resins for electronic, radio, television and telephone equipment.

Consult your Calco representative for full information, and remember . . . Calco's Technical Service staff, with the facilities of its full-time plastics research laboratory, is available to help with any of your coloring problems.

"Calco Products for the Plastics Industry"

Pigments

Ultramarines
Cadmiums
Chrome Yellows, Oranges and Greens
Phthalocyanine Blues and Greens
Iron Blues
Organic Toners and Lakes
UNITANE® (Titanium Dioxide)
Anatase and Rutile Types

Dyes

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able quality and limited quantities of bristle obtainable from other countries made the increased production of tapered synthetic bristle mandatory.

Neoceta bristle possesses the same durability as hog bristle, and is used either mixed with hog bristle or alone.

Enamel for Polyethylene

DEVELOPMENT of a new synthetic enamel called Polynamel, designed to solve the problems of coating and decorating polyethylene, has been announced by Schwartz Chemical Co., Inc., 326 W. 70th St., New York 23, N.Y.

The new lacquer has excellent adhesion and withstands the finger nail and Scotch Tape tests. Company chemists claim that it does not peel or chip, and has unusual toughness and flexibility. Although the coating can be air-dried, the producer recommends that it be baked or force-dried at 150° F. for 1 hr. for best results. It can be applied by spray or brush.

Polynamel is available in a wide range of colors to meet the requirements of manufacturers of polyethylene products in the toy, plastics, and packaging industries. It is packed in 1- and 5-gal. cans and 55-gal. drums, ready for immediate delivery.

For Laboratories and Research

DEVELOPMENT of a business that has made a specialty of supplying plastics products to laboratories and medical supply houses is the record of Bel-Art Products, 2209 Central Ave., Union City, N.J. The company announces that it is now particularly active in the sale of polyethylene tubing, which is made to Bel-Art's specifications for the particular benefit of its trade. The company stocks and sells any amount of tubing—from 1 ft. up—and, in addition, provides polyethylene bottles, funnels, beakers, tumblers, graduated cylinders, and polyethylene sheeting 0.0015 in. thick and 54 in. wide.

Other plastics products offered to the synthetics trade are vinyl dust covers for instruments and equipment; sleeve protectors; thermometer cases; aprons; vinyl mattress and pillow case covers; vinyl sheets and sheeting; rigid cellulose acetate instrument covers and bell jars; acrylic bell jars; and containers for such products as tongue depressors and instruments.

Plasticizer

ISO-OCTYL palmitate is a new, commercially available organic palmitate of high purity produced under the designation 0-16 by Rubber Corp. of America, 274 Ten Eyck St., Brooklyn, N.Y. As a secondary plasticizer in polyvinyl chloride compositions, 0-16 adds anti-blocking properties and increases the heat stability by functioning as an internal lubricant. In vinyls, plasticizer 0-16 is usually used to replace 10 to 15% of the other plasticizers in the compound.

Training Program

AN apprentice training program for tool and mold making is now in operation at the plant of Guy P. Harvey & Son Corp., Leominster, Mass. The program consists of four terms, totaling 10,000 hr. of training in all phases of the business.

A Decal for Economy

THE perfection of a special type decal, Rubber-Cal, for practical and economical marking or decoration of rubber products and rigid as well as elastomeric plastics has been announced by the American Decalcomania Co., 4334 Fifth Ave., Chicago, Ill.

Rubber-Cal can be printed in any number of colors and in any size, shape, or design. Available in open designs or in designs with solid backgrounds, this new development appears to become part of the surface, after transferring, upon which it is applied. The company claims that it is actually indistinguishable as a transfer.

COMPANY NOTES

Federal Leather Co., Belleville, N. J., has named **Reese B. Davis & Co.**, Forth Worth, Texas, sole distributors of its products in that state. Anticipating a sales increase of over 30%, Reese B. Davis & Co. will move from 813-51 Lamar St. to larger quarters.

Peter Muller-Munk Associates has moved to 725 Liberty Ave., Pittsburgh 22, Pa.

Shell Chemical Corp. announces the appointment of **G. W. Huldrum, Jr.** as sales manager of the **Eastern Div.**, and **V. C. Irvine** as **Western Div.** sales manager. Mr. Huldrum replaces **J. G. Frye,** who has resigned to take up another post, and Mr. Irvine replaces Mr. Huldrum. Mr. Huldrum will supervise all sales activities east of the Rockies for Shell's solvents, resins and plastics, and industrial chemicals. His headquarters will be at 500 Fifth Ave., New York, N. Y. Mr. Irvine will head sales activities in ammonia and ammonium sulphate, fertilizers, solvents for varnishes and lacquers, plastics and resins, and industrial chemicals west of the Rockies. His headquarters will be at 100 Bush St., San Francisco, Calif.

Gordon-Graf Co., Inc., 1609 Willington St., Philadelphia 21, Pa., a newly formed organization, will carry on the hydraulic equipment manufacturing business of **Gordon & Son.** Company officers are as follows: **John C. Graf,** president; **Samuel D. Gordon, Sr.,** vice president; **John R. Graf,** secretary; and **Thomas Gordon,** treasurer.

U. S. Rubber Co. has appointed **German C. Flick** sales manager of its decorative plastic topping material, Satusply, and of its plastic wall covering, Naugawall. His headquarters will be in the company's Mishawaka, Ind., plant where the products are made. Mr. Flick succeeds **Edward Walsh,** who has now assumed other sales responsibilities in the company's Fuel Cell Division.

Rogers Plastic Corp., West Warren, Mass., announces the following promotions: **Russell Nadeau,** vice president and general manager of the plant in West Warren; **Robert Campbell,** vice president and general manager of the Canadian plant at Rawdon, Quebec.

American Society for Testing Materials announces the election of **Robert J. Painter** as executive secretary and **Raymond E. Hess** as

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The world's finest facilities for salvaging plastics scrap and by-products of the plastics industry...

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Vinyl and Polyethylene for
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We specialize in the reduction to small particles — to your most exacting specifications — of all lumps, blocks, mill ends, bleeder waste — regardless of size and whether rigid or soft.

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PLASTICS MATERIALS

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associate executive secretary and editor-in-chief. This action was taken by the Board of Directors, following a report of a special committee which had been appointed to recommend a successor to the late **C. L. Warwick**, long-time executive secretary of the Society, who died on April 23.

Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill., announces the establishment of the following three new district offices: 900 Monroe, N. W., Grand Rapids 2, Mich.—**Robert P. Campbell**, district manager; 307 E. 4th St., Cincinnati 2, Ohio—**Edmund C. McFaul**, district manager; 432 East Pike St., Clarksburg, W. Va.—**Earl J. Kelly**, district manager. A sub-office in Clarksburg is located at 945 Somerset Dr., Charleston, W. Va.; **J. McKeown** is in charge.

Taylor-Wharton Iron & Steel Co., Cincinnati, Ohio, has added two engineers to the staff of the **Research and Development Dept.** at Easton, Pa.: **John J. Reed**, chemical engineer, formerly assistant to the director of the Development Engineering Dept., Panelyte Div., St. Regis Paper Co., and **William Rademaekers**, industrial engineer, formerly assistant project engineer for Sperry Gyroscope Co. Taylor-Wharton is considered one of the largest manufacturers of high pressure gas cylinders. During the past year, they have entered into an extensive program to research the possible use of a plastic cylinder reinforced with spun glass. The company is equipped with laboratory and research facilities at its Easton plant, and both men are assigned to carry on work in this program.

H. K. Porter Co., Inc., Pittsburgh, Pa., has acquired **The Watson-Stillman Co.**, Roselle, N. J. Operations at Watson-Stillman will continue under the direction of **Edwin A. Stillman**, president. The Watson-Stillman **Fittings Div.** will be operated as a division of H. K. Porter Co., Inc.

This acquisition is in line with Porter's continuing policy of diversification. In a little over two years, Porter has expanded its operations into rubber, steel, electrical equipment, and forged steel fittings.

Lind Plastics Products, manufacturers of custom molding, moved into a new plant at 6900 N. Central Park Ave., Chicago, Ill. **Carl J. Lind** is president and **Ted N. Lind, Jr.,** general sales manager.

Fabricon Products, Inc., Plastics Div., 1721 W. Pleasant Ave., River Rouge 18, Mich., has installed a vertical impregnating machine in its Los Angeles plant. This treater will be used primarily for the impregnation of melamine decorative and overlay papers to serve the Pacific Coast area.

Witco Chemical Co., 295 Madison Ave., New York, N. Y., has appointed **Lester D. Koch** eastern sales manager. He is also a vice president of the company and will continue to supervise the operations of the **Export-Import Dept. Otto F. Slonek** has been added to Witco's staff in a technical sales service capacity on chemicals. He was formerly manager of Industrial Chemical Service, Inc., Houston, Texas.

Dixon Saddle Co., Bristol, R. I., is offering Rulon as a plastic material to be used in the manufacture of bearings that have been developed especially for use in drafting assemblies of textile spinning mills, but can easily be applied to other applications. The material requires no lubrication and is slippery throughout, from outer skin to inner core. No sealed-in lubricant nor lubricant impregnation is needed. Rulon has a low coefficient of friction, withstands temperatures over 400° F., and is chemically inert. The specific gravity is 2.2.

Aetna-Standard Engineering Co., Pittsburgh, Pa., has named **A. L. Thurman** manager of the **Plastics & Rubber Machinery Div.** He was assistant to the vice president at Ellwood City, Pa., and will now conduct his activities from the Warren, Ohio, plant. The company entered the rubber and plastics machinery business about two years ago and had appointed **Hale & Kullgren, Inc.,** Akron, as its engineers and sales representatives. Earlier this year, Aetna-Standard augmented its business by purchasing the **Rubber and Plastics Machinery Div.** of **National Erie Corp.,** Erie, Pa.

Fiber Glass Div., Libbey-Owens-Ford Glass Co., announces the following appointments: **Richard Harper,** a sales representative of the division at 1437 Statler Bldg., Boston; **Robert W. Andree**, a sales representative of the New York office at 570 Lexington Ave.; **John T. Shute,** district sales manager of the Chicago division, with headquarters at 120 S. La Salle St.

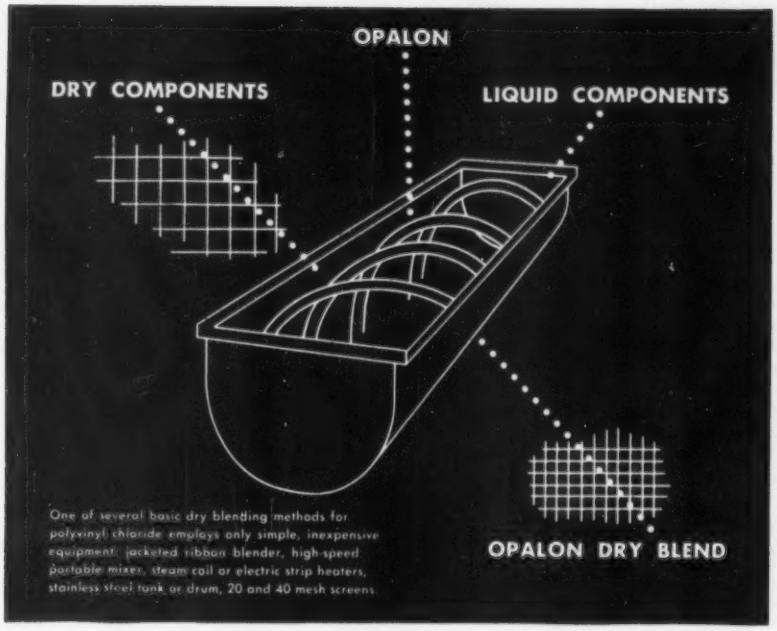
Ciba Plastics Div. of the **Ciba Co., Inc.,** New York, N. Y. has appointed **Furane Plastics, Inc.,** 719 W. Broadway, Glendale, Calif., regional sales agency in California, New Mexico, Washington, and Oregon, to augment, on a non-exclusive basis, the previous appointment of **Chemotec Div., Eutectic Welding Corp.,** Flushing, N. Y., as national sales agency for Araldite epoxy resins for adhesive uses. Furane Plastics will handle all Araldite resin sales in the aforementioned states. For all uses other than metal bonding outside of Furane's territory, Ciba will service direct from its offices in New York and Chicago.

U. S. Plywood Corp. has appointed **Kalflex, Inc.,** 103 Park Ave., New York, N. Y., exclusive distributors of Kalistron and Flexwood in the eastern New York state area. Kalflex will offer sales and installation service to architects, decorators, home owners, and builders, and will guarantee all installations.

Columbia Protektosite Co., Inc., a subsidiary of **Curtiss-Wright,** has named **Joseph Swersey** assistant sales director in charge of chain store operations and merchandising.

Flexible Tubing Corp., Guilford, Conn., announces the appointment of **Reed A. Weyburn** as sales representative.

Pittsburgh Plate Glass Co.'s Fiber Glass Div., organized less than a year ago and with plant facilities at Shelbyville, Ind., for less than half that time, has started production of superfine fibrous glass. The **Fiber Glass Div.** plans to bring in a furnace a month until four tanks are in operation for producing superfine fiber


OPALON
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Low equipment cost . . . At the very outset, the average vinyl extruder can save up to $50,000 in equipment costs alone by dry blending Opalon 300 vinyl resin. The dry blend process of vinyl compounding can be set up for about *one-sixth* of a conventional granulated compound production unit.

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PLASTISCOPE

and 50 bushings are operating for production of continuous or strand fiber. The Shelbyville plant is expected to be operating at capacity by early next year.

Heyden Chemical Corp., 342 Madison Ave., New York, N. Y., announces a realignment of its top management. **John P. Remensnyder** was elected chairman of the board; **Simon Askin** was named president; and **Barrett Brown**, partner of **R. W. Pressprich & Co.**, was elected a director to succeed **Dr. Donald B. Keyes**, who has resigned.

Givaudan-Delawanna, Inc., 330 W. 42nd St., New York, N. Y., has named **R. E. Horsey** vice president in charge of sales for the company and its affiliate, **Sindar Corp.** The appointment will consolidate the sales management of both companies.

Herbert H. Cooper, Inc., has moved to 723 E. California St., Pasadena 5, Calif.

Plaskon Div., Libbey-Owens-Ford Glass Co. has appointed **Robert K. White** as merchandising specialist for the company's products.

Synthane Corp., Oaks, Pa. has named **E. Eldridge Smith** sales manager. He succeeds **Herbert Widdop** who became manager of the Order and Service Dept. Mr. Smith joined the company in 1942 as a salesman. Subsequently, he headed the Philadelphia office, becoming assistant sales manager of the company in 1948. Synthane also announces the retirement of **Lewis C. Rowland**, superintendent of fabrication, after 20 years of service. **Joseph Estock**, night superintendent for the past 10 years, succeeds Mr. Rowland.

Bakelite Co., Div. of Union Carbide & Carbon Corp., announces the formation of a new sales unit, the **Industrial Products Dept.**

Howard Smith has been named manager of the department, which will be responsible for the operations of the consolidated **Surface Coatings, Halowax Products**, and **Sheet and Foil Divisions. Carl W. Patton** has been appointed manager of the **Surface Coatings Div.**, which will be accountable for operations heretofore conducted separately by the former **Thermosetting Dept., Varnish Resin Div.**, and the **Thermoplastics Dept., Coatings and Adhesive Materials Div. M. E. Delaney** was named manager of the Halowax Products Div., and **T. W. Sharp** will continue as manager of the Sheet and Foil Div.

Bakelite stated that the establishment of the new department is another step to consolidate the company's sales activities.

Connecticut Plastilight Corp. announces the expansion of its plant at 481 Canal St., Stamford, Conn., by 20,000 sq. ft. to accommodate its growing **Industrial Laminates Div. John E. Currier**, plastics sales engineer, with offices at Stamford and 60 East 42nd St., New York, N. Y., will handle the sales and servicing of the industrial laminates. The company states that it is prepared to offer standard NEMA Grade laminated sheets, as well as special materials made to Government specifications. Connecticut Plastilight's latest developments include metal-clad laminates for printed circuits and laminates of DAP and Epon resins, with glass cloth or synthetic fibers as fillers.

Gries Reproducer Corp., 780 E. 133rd St., New York, N. Y., producers of zinc die casting and various types of fasteners, announces the appointment of **John J. McDermott** as sales engineer in the metropolitan area of New York and New Jersey. Mr. McDermott, qualified to offer technical assistance to manufacturers desiring contract production of zinc die castings and plastic injection moldings, will also cover sales of the company's line of fastenings and other standard industrial components, in the same area.

C. J. McAvoy Co., 1321 S. Barksdale St., Memphis, Tenn., has been appointed to represent GRC in Tennessee, Mississippi, and Alabama.

W. C. Dillon & Co., Inc., 14620 Keswick St., Van Nuys, Calif., a company comprised of a father and six sons, has built a new 12,000 sq. ft. plant on a 2-acre site. The company produces precision test apparatus, such as dynamometers, testers, and pressure gages.

Russell Reinforced Plastics Corp., Lindenhurst, N. Y., has doubled its capacity for the production of reinforced laminate parts. In addition to a large battery of matched die molding presses and a 700-ton machine which produces flat panels up to 4 by 9 ft., Russell recently added a number of large hydraulic presses, including one 10 ft. long with 66 in. of daylight. A 48-in. Brenner preform machine has also been installed.

Pittsburgh Plate Glass Co.'s new **Fiber Glass Div.** announces the establishment of district sales offices in Detroit, Chicago, and New York City. The following district sales managers have been appointed:

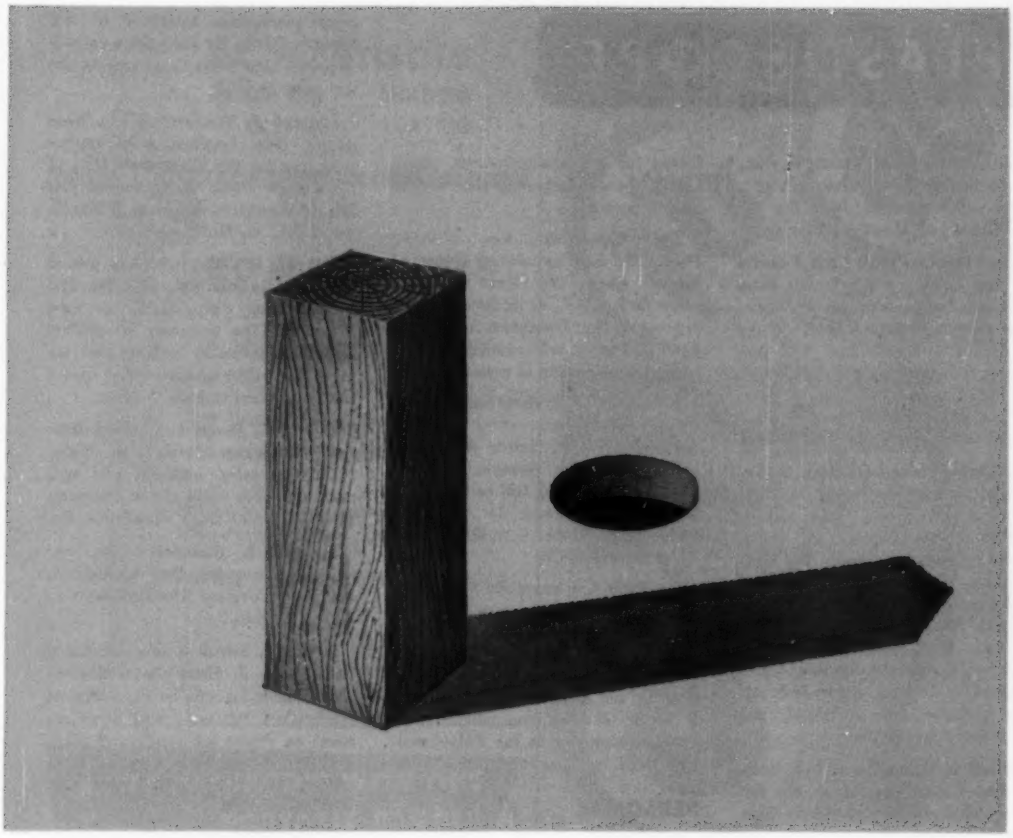
Charles E. Barby will serve in Detroit with offices at 6045 Hamilton Ave. He has been with the parent company since 1939. **Charles B. Keown** will be in Chicago, with offices at the Engineering Bldg., 205 W. Wacker Drive. Mr. Keown was formerly western sales manager for Pittsburgh Corning Corp. for 12 years. **P. D. Kaley** will serve in New York City with headquarters at 30 Rockefeller Plaza. Mr. Kaley is particularly well known in the polyester-glass industry, where he has served as a representative of Owens-Corning and as a technical consultant in Washington, D. C.

Goodren Products, 136 W. 21st St., New York, N. Y., has appointed **Austin & Austin, Inc.**, 1775 Broadway, to handle the sales of its new transparent, moistureless sign and product label, Goodstix, in the metropolitan area.

Steiner Plastics Mfg. Co., Inc., Glen Cove, N. Y., announces that **Walter Worrell** and **Frank A. Bond** have joined the company. Both men were formerly associated with Rohm & Haas Co.

R. S. Aries & Assoc., New York, N. Y., have opened a Detroit branch office., with **R. A. Willinganz** in charge. He was formerly affiliated with Union Carbide & Carbon Corp. and Chrysler Corp. Mr. Willinganz's address is 15336 West Warren Ave., Dearborn, Mich.

Wilson Plastics, Inc., Sandusky, Ohio, manufacturers of Wilson Lockback Plastic Wall Tile, has ap-



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Elastex 10-P Plasticizer—(DIOP)*
"Elastex" 28-P Plasticizer—(DOP)
"Elastex" DCHP Plasticizer
"Elastex" 50-B Plasticizer*
Dibutyl Phthalate

Barrett*

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PLASTISCOPE

pointed **Gold Bond Products, Inc.**, 742 Market St., San Francisco, Calif., as its sales representative for the West Coast and Mountain States.

Monsanto Chemical Co.'s Plastics Div. has opened a Cincinnati sales office, making a total of six divisional sales offices operating this side of the Rockies. The new office will also support the activities of the division's new production facilities at Port Plastics, Ohio, where the manufacture of industrial resins has started.

Parkwood Laminates, Inc., Wakefield, Mass., announces the appointment of **Parkwood Distributors,** 4072 Park Ave., Bronx, N. Y., to handle its complete line in the metropolitan, Westchester, Long Island, and northern New Jersey areas. **John H. Smith,** Kent Manor, Kew Gardens, N. Y., will continue as Parkwood Laminates' representative to assist in solving decorative, design, architectural, technical, and promotional problems.

DeBell & Richardson, Inc., Hazardville, Conn., announces the following changes in personnel: **Kenneth T. Barker,** who has been handling chemical engineering plant design, has transferred as chief engineer to **Shore Line Industries,** Clinton, Conn.; **Sven Richter,** consulting engineer, has joined the company to succeed Mr. Barker. **Fred E. Wiley** has returned to DeBell & Richardson to supervise mechanical engineering and test procedures.

Melkor Research Laboratories, 11712 Detroit Ave., Cleveland, Ohio, announces the development of a plastic material that withstands continuous temperature of 360° F. and possesses a high dielectric strength. Known as Melkorite, it is particularly advantageous where hermetic sealing and gas sealing under pressure is needed for perfect functioning of electrical components.

Grace Chemical Co., has been formed as a subsidiary of **W. R. Grace & Co.**, 60 Beaver St., New York, N. Y. A 277-acre site in the Woodstock area, about six miles from Memphis, Tenn., has been selected for an ammonia-urea plant, the first manufacturing unit of the new company.

The Richardson Co., Melrose Park, Ill., has appointed **Overseas Export Corp.**, 250 West 57th St., New York, N. Y., as its foreign sales representative. Overseas, headed by **Fred R. Pinter,** will represent Richardson's entire line of products.

National Polychemicals, Inc., Boston, Mass., announces the appointment of **Dr. Henry A. Hill** as assistant manager, responsible for all manufacturing and technical activities of the company. Dr. Hill was formerly associated with Dewey and Almy Chemical Co.

Du Pont has announced that **Edward J. Pechin,** for more than two years manager of plastic sales in the company's **Polychemical Dept.,** has been appointed to a managerial position in the Advertising Dept. **Jerry D. Shaw,** who has been been market analysis manager in the **Polychemicals Dept.,** will succeed Mr. Pechin.

PERSONAL

William G. Potts has been transferred from the **Engineering Dept.** to the **Plastics Machinery Sales Dept.** of **National Rubber Machinery Co.**, Akron 8, Ohio.

L. F. Reimann has been promoted to assistant vice president of manufacturing at **Jackson & Church Co.,** Saginaw, Mich.

George W. Roper has been promoted to the position of assistant technical director of the **Dust and Fume Control Div.** of **American Wheelabrator & Equipment Corp.** at Mishawaka, Ind.

Norry W. Hastings has been named chief chemist for **Rezolin, Inc.**, Los Angeles, Calif., manufacturers of Non-Shrink Tool-Plastik used to replace conventional materials in the making of dies and patterns.

Jack D. Porter has been appointed to the Sales Promotion Dept. of **The Goodyear Tire & Rubber Co.**, where he will coordinate the advertising and sales promotion activities of the **Chemical Div.** He has held a variety of production posts since joining the company in 1933.

Duncan J. MacLennan has been named New England sales representative for the **Plasticizer Div.** of **Pittsburgh Coke & Chemical Co.** His headquarters will be at 79 Knollwood Rd., W. Hartford, Conn.

Harvey H. Morrison has joined **Stillman Rubber Co.**, 5811 Marilyn Ave., Culver City, Calif., as vice president. The company specializes in rubber-to-metal bonding and has modern facilities for transfer, injection, and compression molding.

Robert L. Bouse has joined **Bassons Industries Corp.**, New York, N. Y., as sales engineer and will head the sales office of the company at 401 N. Broad St., Philadelphia, Pa.

Kenneth R. Blaisdell is the new field engineer in the Springfield, Mass. territory for **The Bellows Co.**, Akron 9, Ohio.

Arthur L. Smith is now associated with **Rohm & Haas Co.**, Philadelphia, where he will be in charge of application research and development on resins for reinforced plastics. Mr. Smith was formerly connected with Continental Can Co., Cambridge, Ohio.

Dewey Rainville has announced the opening of manufacturers' representatives offices in Garden City, N. Y. He is metropolitan New York district representative for **Manco Products, Inc.**, Melvindale, Mich., producers of Tru-Cast beryllium copper cavities and cores for the plastics industry.

Joseph S. Imirie has been appointed assistant to the president of **The Carborundum Co.**, Niagara Falls, N. Y. He will assist in the general management of the company's business and in the development of company objectives, policies, organization structures, and programs. Mr. Imirie has been with the company since Jan. 1952, prior to which time he was Deputy Under-secretary of the Air Force.

Tom B. Nantz is now manager of **B. F. Goodrich Chemical Co.'s** new $5 million vinyl plastic monomer plant in Calvert City, Ky., which is in its final construction stages. He was formerly plant manager at the

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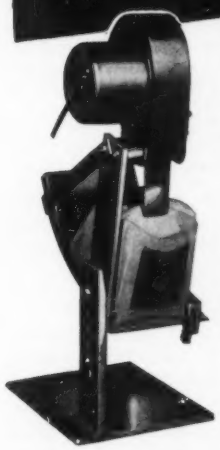

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Institute, W. Va., GR-S rubber plant, operated for the Government by B. F. Goodrich. Mr. Nantz joined the company's laboratories as a chemist in 1937.

Roger B. White, president of **The Glastic Corp.**, Cleveland, was designated as a representative of the Reinforced Plastics Industry to address the personnel of **General Electric Co.** on new developments in the polyester glass field that apply to electrical insulating applications, such as elevated temperature operation, increased physical strength, and higher arc resistance.

Arnold A. Weiner has been elected vice president in charge of sales for the **Upholstery** and **Automotive Divs.** of **Bolta Products Sales, Inc.**, Lawrence, Mass. He joined the organization in 1946.

EXPANSION

Swedlow Plastics Co. has opened its third manufacturing facility at Los Angeles, Calif. The new 37,000 sq. ft. plant is located on a three-acre plot at 6986 Bandini Blvd. This brings Swedlow's manufacturing facilities to a total of over 70,000 sq. ft. in the Los Angeles area. The company's general offices have been transferred to the new plant.

Pittsburgh Coke & Chemical Co. has announced that its 35 new coke ovens reached full operation in October, thus marking the first goal of a $20 million expansion at its Neville Island plant, five miles down the Ohio River from Pittsburgh. The battery of coke ovens is one of eight units in the expansion program, which will be completed early next year.

The company's total sales of chemicals have grown from less than $4 million in 1947 to more than $18 million in 1951, an increase of some 390% as against a gain of 125% in the sales of its other products. The new ovens, which cost $6 million, will give the firm a total of 140 by-product ovens.

Some $3,300,000 of the present expansion budget is allocated to additional chemical facilities. However, this is on top of more than $7 million spent in the past four years for new chemical plants. Together with capital expenditures from 1947 to 1951, Pittsburgh Coke & Chemical has committed $34 million to plant expansion and improvements since the war. Included in the plants now under construction is a commercial unit for the production of plasticizers. The new plant will boost Pittsburgh Coke's plasticizer production to more than a million pounds a month.

Typical of Pittsburgh Coke's closely integrated operations is the fact that molten phthalic anhydride, a basic ingredient of many plasticizers, is piped directly to the new plant from a nearby phthalic plant. This simplifies production and helps to cut production costs.

Monsanto Chemical Co. has completed construction of a dioctyl phthalate plant at Everett, Mass. Operation of the plant, constructed jointly by the **Merrimac** and **Organic Chemicals Divs.**, will start immediately.

Phthalic anhydride, raw material for the DOP unit, is manufactured in an adjoining unit at the Merrimac Div. headquarters.

Wizard Boats, Inc., Costa Mesa, Calif., is planning a $60,000 expansion program. Curtis A. Herberts, president, stated that the contemplated increase in facilities will enable the company to more than double production and add new products to the present line of Wizard boats. He also mentioned that the organization is considering the establishment of a finishing unit in the Great Lakes region where molds and trim will be added to the Fiberglas shells for distribution in the East and Middle West. Hulls will continue to be made at the Costa Mesa factory.

Ace Plastic Co. is currently building an extension of 5000 sq. ft. to its building at 91-30 Van Wyck Blvd., Jamaica, N. Y. The extension will enable the company to enlarge its extrusion and fabricating depts., where new machinery will be installed for greater working capacity.

Harte & Co., Inc., 267 Fifth Ave., N. Y., has completed plans for the construction of a plant providing 55,000 sq. ft. of manufacturing space in Brooklyn, N. Y. The structure will provide a greater output of Wataseal vinyl film and permit expansion of the company's production of polyethylene film under the Plicose trade mark. Full use of the present plant for the manufacture, printing, and embossing of Wataseal vinyl film will be continued. General offices and showrooms will remain at the Fifth Ave. address.

Deceased

Saul Optner, president of Plastic Service Corp., La Porte, Ind., died on October 13. He was formerly vice president of Ranger-Tennere, New York, N. Y.

Fred H. Haggerson, chairman of the board of Union Carbide & Carbon Corp., died on October 14. He had been with the organization for over 33 years and became chairman of the board in 1951.

MEETINGS

Dec. 3-5—Society for Experimental Stress Analysis, Annual Meeting and Exhibit, McAlpin Hotel, New York, N. Y.

Dec. 4-5—Society of the Plastics Industry, Fourth Film, Sheeting and Coated Fabrics Division Conference, Commodore Hotel, New York, N. Y.

Dec. 7-10—American Institute of Chemical Engineers, Hotels Cleveland and Carter, Cleveland, Ohio.

Jan. 15-22—National Housewares Manufacturers Association, Annual Winter Exhibit, Navy Pier, Chicago, Ill.

S. P. E. Meetings

Dec. 19—R. W. Powell, Hydraulic Press Mfg. Co., will deliver a talk to the Buffalo Section on "Pre-plasticizing."

Jan. 16, 1953—T. A. DeMarco, Monsanto Chemical Co., will address the Buffalo Section on "Glass Fiber Reinforced Styrene."

Jan. 21-23—Ninth Annual Technical Conference, Hotel Statler, Boston, Mass.

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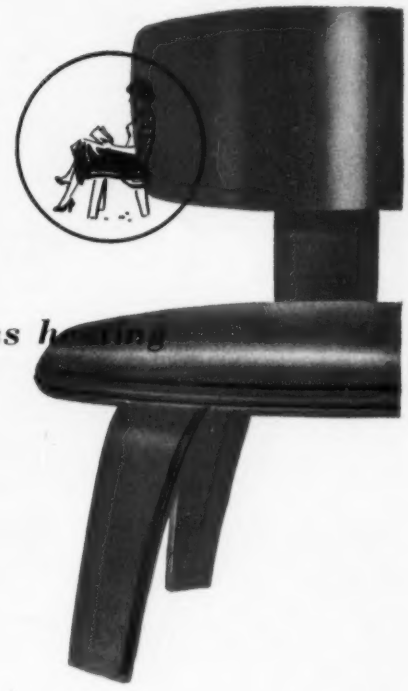

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FOR SALE: 200 TON LAKE ERIE high speed semi-automatic transfer molding press, with upstroke duplex cylinder. Self contained Oilgear Type DP-20 pump, 10 HP 220 Volt 3 phase 60 cycle motor. Electrical controls with return and slowdown limit switches; individual pressure controls for both rams; and timers for holding, breathe and preheat. Platen 39" wide between rods, 30" wide grids, 24" front to back. 6" Top grids, 8" Bottom grids. 20" daylight between grids. Main ram stroke 14" duplex ram stroke 8". Capacity 200 tons main ram, 20 tons pullback; 50 tons duplex ram; 10 tons pullback. Serial No. 2511. Excellent condition, used intermittently for five years, pump practically new. May be inspected in operation. AUBURN BUTTON WORKS, INC., Auburn, N. Y.

FOR SALE: Stokes #200A 10-ton automatic compression press complete, 7 Wheelco Capacitrols, 4 Bristol controllers; also 4300 pounds virgin blue-green Dow Ethocel @ 45¢ pound. WINDMAN BROTHERS, 3325 Union Pacific Ave., Los Angeles 23, Calif.

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrel 16" x 48", and 15" x 36", 2 roll rubber mills. New 6" x 12" and 6" x 16" Lab. Mixing Mills and Calenders. Other sizes up to 84". Royle #1 to #3 extruders, Bethlehem 3000 Ton 10 opening press, 5'-6" x 9'-9" heated platens. 200 ton Brunswick 21" x 21" Platens, 14" Ram, Record Presses. W.S. 100 ton 24" x 24". Elmes 75 ton 30" x 36". Also presses Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250 # W.P. W.S. 4 Plgr. High and low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 5500 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins jacketed mixers 100, 50, 9, & 4½ gals. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N. Y., STerling 8-1944.

FOR SALE: 50 Ton Stokes Presses & Pump. 200 Ton W.S. Hobbing PRESS. 300 Ton W.S. PRESS 24 x 30 Platen, 175 Ton H.P.M. PRESS 30 x 30 Platen, 150 Ton Farrel PRESS 30 x 30 Elec. Plates. 140 Ton W.S. PRESS 23 x 17 Platens, 85 Ton Stewart Bolling PRESS 20 x 20 Platen, 50 Ton Elmes PRESS with 15 x 18 Elec. Plates, 75 Ton W.S. PRESS 15 x 15 Platen, 75 Ton Adamson PRESS 20 x 20 Platens. Laboratory presses, Accumulators, Piston and Oil Pumps. AARON MACHINERY CO., INC., 45 Crosby St., N.Y.C.

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FOR SALE: Thermex Preheater, Model 2P; Airtronics Preheater, Model D E; Airtronics Preheater, Model C B. Like new. AARON MACHINERY CO., INC., WOrth 4-8233, 45 Crosby St., New York 12, N. Y.

3000 TON 6-DAYLIGHT PRESS BY JOHN SHAW; steam platens 8'6"x4'4" with Pumping Equipment. Unused. 2600 ton 6-daylight Press; steam platens 6'4"x3'3". 1000 ton Downstroke Moulding Press, table 5' square. 48"x20" 5-roll Calender by Farrell with motor drive. 48"x18" 3-roll even friction Calender by Robinson with motor drive. Two 36"x22" 3-roll Calenders by Bridge with motor drive. Large stock of Hydraulic, Plastics and Rubber Machinery. REED BROTHERS (ENGINEERING) LTD., Replant Works, Cuba Street, Millwall, London E. 14, England. Cables—REPLANT LONDON.

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FOR SALE: 1—Farrell 20" x 48" Plastic Mill, m.d.; 1—Farrell-Birmingham self-contained 6" x 13" 3-roll vertical Calender, m.d.; 1—Royle 2" oil heated Plastics Extruder; 1—Baldwin 200 ton Molding Press; 1—Colton #5½ Preform Press. Also Grinders, Extruders, Compression and Injection Molding Presses, Mixers, etc. Send us your inquiries. We buy your Idle Equipment. CONSOLIDATED PRODUCTS CO., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

HOBBING PRESS:—Hy-mac 2,000 ton, complete with pump and chases. Ram—30" diameter. Maximum Chase—24" diameter. Complete specifications sent on request. Price—$10,000, F.O.B. Plant, Toronto, Ontario. Reply Box 1217, Modern Plastics.

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12 oz.	232-3S-27-12
8 oz.	303-L-2-½-8
12 oz.	289-3S-27-12
8 oz.	312-L-2-½-8
6 oz.	162-2B-44-6
12 oz.	294-3S-27-12
4 oz.	Identical to 4-900

Can be seen in operation. Subject to prior sale. Wire Box 1220, Modern Plastics for further information.

FOR SALE: Sheridan #17 Embossing Press (54x26) with automatic feed and rewind attachment and automatic dwell attachment. Practically new. Reply Box 1221, Modern Plastics.

TWO WERNER-PFLEIDERER #15 UNIVERSAL MIXERS, 100 gallon finished capacity, heavily built, steam jacketed, geared on both ends, side tilt. Each with 15 H.P. motor, with variable speed control. Reply Box 1236, Modern Plastics.

TWO AMERICAN PULVERIZER PLASTIC GRANULATORS. Type KC, 9x9, ser. #3177 and 3178, throat opening 10"x6¼". Includes stand, sheave, V-belts, screen and hopper. 2 years old. Used very little; excellent condition. $600.00 each, F.O.B. plant. Inspect them at SANDEE MANUFACTURING COMPANY, 5050 Foster Ave., Chicago 30, Illinois. Phone AVenue 3-2800.

MARKEM UNIVERSAL EMBOSSING MACHINE Model Husky-6, SN 12 7, new in 1943, ½ hp, 3 phase 220-440 V motor. Used for embossing variable detail on plastic knobs and similiar indicator buttons; can also be used for embossing flat details on various flat or rectangular objects. Cheap. SAM MACHINERY, INC., 235 Centre St., New York 13, N.Y., WOrth 2-6565.

FOR SALE: 1—Ball & Jewell No. 1½ Rotary Cutter, stainless steel. 3—Mikro Pulverizers #1-SH, #2-SI, #2-TH. 2—Kux Rotary Pellet Presses. 6—Stokes Rotary Pellet Presses. Read 600 gal. Jacketed Ribbon Mixer. Large stock stainless steel tanks and kettles. PERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa

6-BUTTONDEX MACHINES, Excellent Condition $400. each. MOLDED PLASTIC BUTTON CORP., 63-17 Rockaway Beach Blvd., Arverne, N.Y.

FOR SALE: Reinforced Plastics Press 54"x144" Platen. Injection Presses: 4,9 oz. HPM, 4,9,12,16 oz. Lesters, 16 oz. Watson, 22 oz. Impco VF 822 model. 1 oz. VanDorn. 1-Mold Temp. Control unit. 2-scrap grinders. Ovens. 150 tons transfer presses, 3,12 & 40 tons Lab. presses. Preform presses: Colton E, Stokes T, Kux No. 25. No. 9 Sheridan embossing press. 42" slitting & rewind. machine. 7½ HP Reliance Varidrive. 3 HP Gas boilers. List your surplus equipment with me for prompt action. JUSTIN ZENNER, 823 W. Waveland Ave., Chicago 13, Ill.

FOR SALE AT TREMENDOUS SAVINGS: Colton 2 and 3 RP Rotary Tablet Machines. Mikro 18H, 3TH, 4TH Pulverizers; Jay Bee and Schutz O'Neill Mills. Baker Perkins & Readco Heavy Duty Steam Jacketed, Double Arm 50, 100, 150 gal. Mixers. Baker Perkins 150 gal. D. A. Unidor Jacketed Mixer. Baker Perkins 100 gal. D. A. Vacuum Mixers. J. H. Day from 8 up to 75 gal. Imperial and Cincinnatus D. A. Jacketed Sigma Blade Mixers. Day & Robinson 100 up to 4000 lbs. Dry Powder Mixers. Pony ML and M Labelrites. Package Machy. FA, FA4. Miller, Hayssen 3-7, Scandia auto. Wrappers. Hudson Sharp Campbell auto cellophane Wrapper. REBUILT AND GUARANTEED. This is only a partial list. Over 5000 machines in stock—available for immediate delivery. Tell us your machinery requirements. UNION STANDARD EQUIPMENT CO., 318-322 Lafayette St., New York 12, N. Y.

PLASTIC MACHINERY—Hydraulic presses, Mills, extruders, tablet machines. M. F. MADIER, 64 Fulton St., New York City.

MACHINERY and EQUIPMENT WANTED

WANTED FOUR 125 LB. SQUARE INCH WP VERTICAL Autoclaves, jacketed, agitated, steel, glass lined, or stainless maximum diameter of jacket 8'x0". Capacity-2500 gallon min. to 4000 gallon max. Reply Box 1233, Modern Plastics.

WANTED: NEW OR USED 2½" or 3½" N.R.M. extruders. Also parts such as cylinders, etc. Reply Box 1201, Modern Plastics.

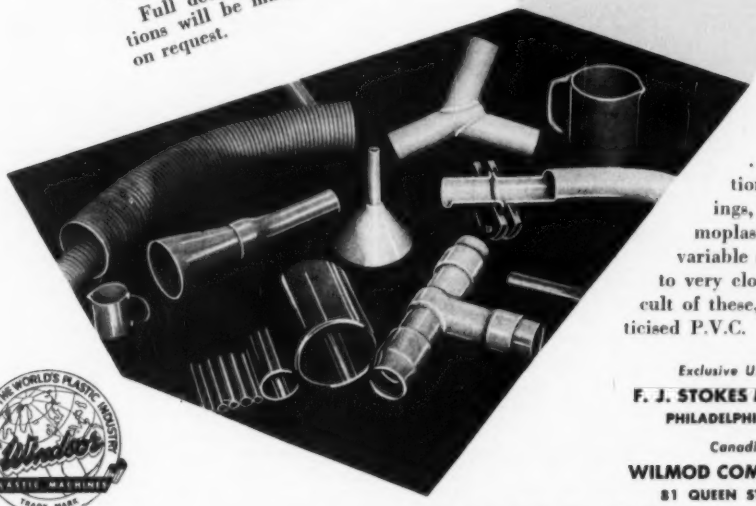
(*Continued on page 212*)

Windsor EXTRUSION MACHINES

this twin-screw R. C. 65 Extruder with variable speed drive

. . . will not only extrude 65 pounds of material hourly, but will compound, pelletise and colour all types of thermoplastic materials.

Full details and specifications will be mailed to you on request.



. . . produces a variety of articles

. . . such as tubes, rods, sections, sheets, multi-colour beltings, etc. in a wide range of thermoplastic materials. The R.C. 65 variable speed extruder will extrude to very close tolerances, the most difficult of these, such as completely unplasticised P.V.C.

Exclusive U.S.A. Representative

F. J. STOKES MACHINE COMPANY

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WILMOD COMPANY, PLASTICS DIV.

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MOULDS, DIES AND ANCILLARY EQUIPMENT

CLASSIFIED ADVERTISING

(Continued from page 210)

WANTED: Plastics and Rubber Processing Machinery including Banbury Mixers, Heavy Duty mixers, Calenders, Rubber Rolls & Mixers, Extruders, Grinders & Cutters. Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a set up plant now operating or shut down. When offering give full particulars. P.O. Box 1351, Church Street Sta., New York 8 N. Y.

WANTED: 8 oz. INJECTION MOLDING MACHINE. State make, price, condition and year purchased, where located. Reply Box 1216, Modern Plastics.

WANTED: COMPRESSION AND INJECTION MOLDING PRESSES by custom molder. Machines to be in good operating condition. Advise complete details, including price. No dealers. Reply Box 1219, Modern Plastics.

WANTED: COMPRESSION MOLDING PRESSES; two, 50 or 75 ton and one 150 to 180 ton. Semi-automatics preferred. Used, must be in good condition. ROGAN BROS., 8031 N. Monticello Avenue, Skokie, Illinois.

WANTED: USED STOKES MODEL R single punch tablet preforming machine. R. E. C. MANUFACTURING CORP., Holliston, Mass.

WANTED: PLASTICS INJECTION MOLDING MACHINES NEEDED. Will buy now or after you have completed your 1952 production in December. Let us look at the machines now so we can act quickly when you are ready to release machines. Reeds, Impcos, Lesters, Fellows. Either individual machines or a complete molding plant. TUPPER CORPORATION, Farnumsville, Massachusetts.

WANTED: Late Model Lester or Reed-Prentice 8 or 12-ounce Injection Machines by Manufacturer. Send All Details to Box 1228, Modern Plastics.

WANTED BY OLD-ESTABLISHED CUSTOM MOLDING PLANT; 1—DD-52 Stokes Rotary Press. Reply Box 1231, Modern Plastics.

WANTED: 8 or 12 ounce USED H.P.M. or WATSON-STILLMAN INJECTION MACHINE. Must be ALL HYDRAULIC, DEEP DRAW. State full particulars when answering: BOLTA PLASTICS LIMITED, Granby, Quebec, Canada.

PLANTS FOR SALE

GOING BUSINESS—Modern Injection Moulding Plant—over 10,000 square feet—fully equipped—location 30 miles from New York City—doing over $500,000.00 sales annually—with capacity for increasing volume of sales—seven injection moulding machines from 4 to 12 ounce capacity—35 productive molds. Real Estate and Buildings included in sale. Principals only. Box 1238, Modern Plastics.

FOR SALE: Complete plant and equipment of a Plastic Moulding Company, (Compression Moulding), consisting of: Modern Toolroom Machinery, Presses, Pumps, Accumulators, and all the necessary ancillary equipment, also included are a LARGE NUMBER OF MOULDING TOOLS, which are for the production of Household Articles, Smoker's Sundries, Fancy Goods, Games, and Toys, etc. The complete plant etc., can be inspected in operation in England, and can be readily shipped overseas as a self-contained unit, which can be put into prompt production. Prepared to sell all the MOULDING TOOLS as a separate item. Interested principles only with the necessary references, write: Box 1226, Modern Plastics.

FOR SALE: Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars address Box 1102 Modern Plastics.

MATERIALS FOR SALE

FOR SALE: 3000 pounds Flesh and Pink Butyrate Molding Powder, reground 28 cents per pound. Reply Box 1202, Modern Plastics.

POLYSTYRENE and CELLULOSE ACETATE RODS ¼" clear and transparent colors, approximately 3000 pounds. CLAUDE P. BAMBERGER, INC., 152 Centre Street, Brooklyn, New York. (Not connected with any other firm of similar name.)

SCRAP P.V.C. and other thermoplastics in all forms. MICHAEL S. STEVENS, MERCHANTS, Keswick Works, Keswick Road, London, S.W. 15, England.

MATERIALS WANTED

WANTED: Plastic scrap such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. CLAUDE P. BAMBERGER, INC., 152 Centre St., Brooklyn 31, N. Y., Tel. Main 5-5553. Not connected with with any other firm of similar name.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 1206, Modern Plastics.

WANTED: PLASTIC Scrap or Rejects in any form. Acetate Butyrate, Polystyrene, Acrylic, Vinyl Polyethylene, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding, magnetizing and compounding. Reply Box 1207, Modern Plastics.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 1671 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

MOLDS FOR SALE

MOLD FOR SALE: Novelty childrens combination glass holder and coaster. Animal shaped. Makes a game out of drinking. Drinking straw is inserted through top of animal figure and passes through its mouth into glass containing milk or other liquid. Nothing to clean—absolutely sanitary. All patent rights and active chain store accounts included in sale. Reply Box 1223, Modern Plastics.

MOLDS WANTED

BRUSH MOLDS & BRUSH MACHINERY wanted for cash. Injection molds for ladies, mens, military, nail, tooth, brushes, etc. Send particulars and samples. Box 47 Realservice, 110 W. 34th St., New York 1, N. Y.

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

MOLDS WANTED: For South American factories: Outright sale, rental, or royalty basis. Housewares, toys, buttons, etc. required. MACHINERY AND EQUIPMENT: Injection and compression machines, extruders, centerless grinders, etc., DAVID ROME ASSOCIATES, 350 Fifth Avenue, New York 1, N. Y.

HELP WANTED

WELL ESTABLISHED Midwestern Proprietary molder has openings for two men in expanding operations. PRESS ROOM PRODUCTION FOREMAN—This opening requires a man with experience in both thermosetting and thermoplastic fabrication; both compression and injection. Opening demands a man with know-how and ability to follow through both actual production and related projects. Would be responsible for efficient operation and results of press room on three shift basis. Extrusion experience would be desirable but not essential. Salary open. PLASTIC PLANT CHEMIST—This opening requires a young chemical engineer with several years experience on both production and laboratory evaluation of plastic materials. Should be capable of supervising the production of molding powders in both thermosetting and thermoplastic types—also maintaining inventories and ordering a large variety and tonnage of plastic materials per month. Experience in extrusion work desirable but not absolutely necessary. Salary open. Send complete details and work record with first application. Reply Box 1200, Modern Plastics.

A MEDIUM-SIZED MANUFACTURER OF PLASTIC-COATED fabric is seeking a working production manager. Practical operating experience necessary. Reply Box 1203, Modern Plastics.

VINYL CHEMIST—Manufacturer of calendered, coated and extruded vinyls requires experienced vinyl chemist in product development. Excellent opportunity in new plastics division. All replies held confidential. Reply Box 1205, Modern Plastics.

CHEMIST: Age 25 to 32; with 3-6 years experience in Plasticizer Development work; familiar with synthesis and end use of phosphate, phthalate type plasticizers; for contact and laboratory work. Please give full information in first letter; age, experience and salary desired. CELANESE CORPORATION OF AMERICA, Newark Plant, 290 Ferry Street, Newark 5, N. J.

ELECTRONIC WELDING SUPERINTENDENT: Prominent midwest converter of plastic film requires a man experienced in managing department engaged in electronic sealing vinyl film. Person must have experience in designing and fabricating electronic sealing dies, supervising personnel operating electronic equipment, organizing production lines, and maintaining electronic equipment. In reply please send resume of experience, training and salary requirements. Reply Box 1214, Modern Plastics.

REPRESENTATIVES WANTED: Company manufactures complete line of products for the plastic industry and for those who use plastic components. Materials also used by glass, electronic, sign, aircraft and many other fields. Exclusive territories available. Reply Box 1212, Modern Plastics.

WANTED—SHIFT SUPERVISOR for Plastics Extrusion Plant. Outstanding opportunity for the right man. Must be alert, aggressive, experienced in extrusion processes. Position requires individual with executive ability, capable in administration of employee relations. MAJOR COMPANY operating the only plastics extrusion plant in southern Ohio and surrounding area, engaged in many challenging projects. Company has generous policy of employee benefits including company-paid insurance. Excellent earning opportunity for man of suitable qualifications. Reply, stating qualifications, Box 1215, Modern Plastics.

(Continued on page 214)

TINNERMAN

Speed Nut Savings Stories

How SPEED NUT Coil Form Fasteners

Transmit 3-way advantage

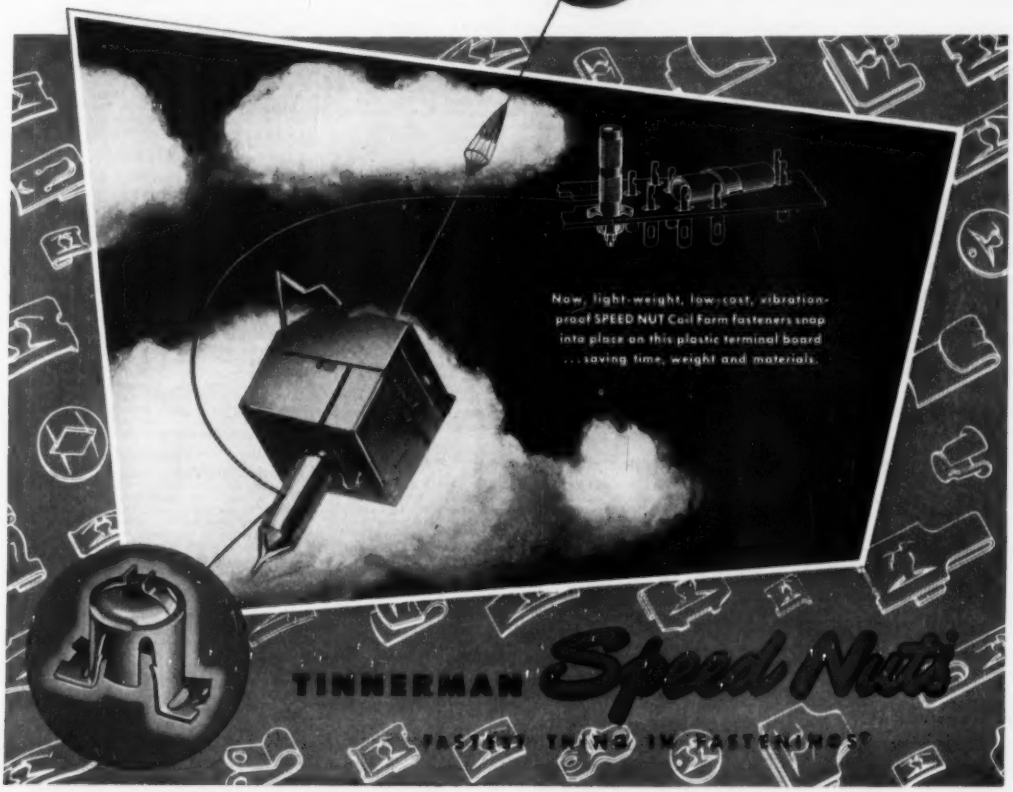
to Weather-Reporting RADIOSONDE

...as told by FRIEZ INSTRUMENT DIVISION of Bendix Aviation Corp., Baltimore, Md.

FRIEZ engineers faced three basic requirements in specifying fasteners for the AN/AMT-4A Radiosonde. First, fasteners had to be *light-weight*, since the device is set free and carried to upper altitudes by balloon. Second, this equipment is expendable, making *economy* a prime factor. And third, because the Radiosonde transmits vital weather data back to the ground, its precise nature demands rigid, *vibration-resistant* fasteners for proper operation. Tinnerman SPEED NUT Coil Form fasteners were selected by Friez after checking many various attaching methods. They more than met the 3-count performance requirement, giving added savings in materials and handling over elaborate machined types.

No matter what your fastening problem, you can rely on a Tinnerman Fastening Analysis to lead the way to production savings. See your Tinnerman representative for details on this free service for your products. And, write today for your copy of SPEED NUT Savings Stories, a booklet of amazing savings to industry: TINNERMAN PRODUCTS, INC., Department 12, Box 6688, Cleveland 1, Ohio.

In Canada: Dominion Fasteners Ltd., Hamilton, Ontario. *In Great Britain:* Simmonds Aerocessories, Ltd., Treforest, Wales. *In France:* Aerocessoires Simmonds, S. A. — 7 rue Henri Barbusse, Levallois (Seine).


Now, light-weight, low-cost, vibration-proof SPEED NUT Coil Form fasteners snap into place on this plastic terminal board ...saving time, weight and materials.
TINNERMAN Speed Nuts

CLASSIFIED ADVERTISING

(*Continued from page 212*)

DEVELOPMENT—SERVICE—As a result of Emery's expansion program in the plasticizer field, an outstanding and challenging position is available for a qualified man in our Development-Service Department to perform: Product Development, Sales Development, Customer Service. Position requires chemistry degree and 3-5 years industrial experience in the fields of plasticizers for vinyls, synthetic rubbers, and resins. CINCINNATI LOCATION, straight salary plus incentive bonus, other liberal employee benefit plans. Apply EMERY INDUSTRIES, INC., 4206 Carew Tower, Cincinnati, Ohio.

SALES ENGINEER. Outstanding opportunity in capital equipment sales—heavy industrial process measuring and control equipment—for a graduate engineer with five plus years of successful capital equipment sales experience and a thorough knowledge of sheet process manufacturing equipment in the paper, rubber, or plastics industry. Our organization is the recognized leader in the development and manufacture of industrial uses of nuclear energy and our continuous expansion offers unparalleled opportunity for a sales engineer capable of working with the executive echelon. Duties include the direction of supporting applications engineers. Qualified applicants are requested to submit a complete resume of education and experience to INDUSTRIAL NUCLEONICS CORPORATION, 1205 Chesapeake Avenue, Columbus 12, Ohio.

WANTED — VINYL COMPOUNDER AND COLOR MATCHER to set up and run new laboratory. Prefer young man not using full capabilities in present position. Reply Box 1222, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Mid-West Custom Injection Molding Company requires representation in Chicago and Mid-West on commission basis. Have excellent assembly facilities which include all types of finishing, painting and decorative work. Reply Box 1224, Modern Plastics.

RESIN SALESMAN: Position open in New York Metropolitan area. Technical background necessary. Experience with polyester resins desirable. Give personal data, training, experience. State salary desired. Reply Box 1227, Modern Plastics.

ESTIMATOR—To compile costs on thermosetting and thermoplastic molded parts. Both experienced and inexperienced men will be considered. CHICAGO MOLDED PRODUCTS CORPORATION, 1046 North Kolmar Avenue, Chicago 51, Illinois.

EXTRUSION AND COMPOUNDING PLASTICS—New York Firm—Located 27 miles from New York City is seeking the services of a Chemist or Foreman to take full charge of new plant. Excellent opportunity, all replies submitted will be held strictly confidential. Mr. Murray Simon, 53 Seneca Ave., Tuckahoe 7, N. Y., Spencer 9-4991.

PLANT MANAGER—To age 40 wanted by long established dealers plastic materials and scrap. Must have knowledge and experience in plastic raw materials; qualified to take full charge as foreman. Excellent opportunity for steady man looking to expansion of sales. Give complete resume, salary expected, etc. Position is on eastern seaboard. Reply Box 1237, Modern Plastics.

WANTED: CHEMIST WITH KNOWLEDGE OF THERMOSETTING PHENOLIC, urea and polyester resins for Sales Work in Eastern Sales Office of large resin manufacturer. Write giving age, educational background and industrial experience, salary requirements, etc. Also, send recent photo. Reply Box 1229, Modern Plastics.

INDUSTRIAL SALES REPRESENTATIVE—Cover Eastern states, representing large manufacturers of phenolic-wood panels whose outlets are in plastics, furniture, toy and novelty and other trade. Our product is sold to industry in both carload and L.C.L. quantities. Our men must be able to plan their own time to best advantage; live some of their work-week away from home; have creative and imaginative ability; be capable of intelligent presentation to top management. The man we want will be 28-35 years of age, married, own a good car and have some industrial background, preferably in woodworking, plastics or furniture manufacture. College education preferred but not required. Our company is one of the old line manufacturing institutions and is expanding with the times. Our new products are backed by long research, development and top notch promotion. Salary, travel expenses and good retirement and insurance program. Send letter and resume to: General Manager, RESINWOOD DIVISION, Rock Island Millwork Company, Rock Island, Illinois. Personal interview, at our expense, will be arranged.

WANTED: Sales Representative to represent small Compression Custom Molder in Northeastern States on a commission basis. Excellent opportunity. Plant located in Eastern Pennsylvania. Reply Box 1230, Modern Plastics.

SITUATIONS WANTED

PLASTICS PRINTING EXPERT with industry-wide reputation seeks executive position. Highly specialized knowledge polyethylene printing techniques, including exclusive pretreating processes and ink formulae. Board experience in setting up plants for silkscreen and rotogravure. Has impressive record in key management post. Energetic. Personable. Five languages. Will bring full know-how to responsible position USA or Europe. Reply Box 1234, Modern Plastics.

VACUUM FORMING SHEET PLASTICS: Successful, practical executive, thoroughly experienced in all phases of vacuum forming production, costs, sales, and engineering. Capable of setting up entire department, training help, and handling model and mold making, preprinting, die cutting, and heat sealing. Can construct necessary equipment. Solid background of accomplishment, excellent references. Recognized as a leading expert. Reply Box 1210, Modern Plastics.

DEVELOPMENT ENGINEER: PLASTICS APPLICATION. Fifteen years diversified experience; polyester laminates, plastisols. Development lacquer and hot-melt coatings, ink and resin research. Excellent mechanical aptitude, administrative ability. Ph. D. in polymer chemistry, associate editor plastics publication. Patents. Desires position as development supervisor within 200 miles N.Y.C. Reply Box 1211, Modern Plastics.

I AM OFFERING: Excellent opportunity for you, Mr. Custom Injection Molder, to acquire an aggressive and intelligent young man for your sales force, age 29, married, with 9 years of injection molding experience. I WOULD LIKE: A position with a growing and progressive custom molding concern. Reply Box 1218, Modern Plastics.

EXECUTIVE TYPE-SALES ENGINEER: 8 years experience in custom molded, blown, and extruded plastics. College graduate, age 38. Now serving as manufacturer's representative in Metropolitan New York-New Jersey area with excellent contacts—most known accounts and personnel. Can devote time to one other line. Draw against commission. Reply Box 1209, Modern Plastics.

INDUSTRIAL ENGINEER, experienced in all phases of time-motion study, standards, job evaluation, methods improvements, etc., now in U. S. Navy, but being released in January, desires position with plastics manufacturing firm. Also desires to develop plastic razor blade (patented), with agreement on assignment of patent rights, as a contract of employment. Complete resume furnished. Reply Box 1225, Modern Plastics.

SERVICES OFFERED

MANUFACTURERS' AGENT concentrating on northern New Jersey industrial accounts. Established since 1945 promoting sale of industrial protective coatings—elastomer plastisol compounds—resinous coated glass textiles—Epoxy casting resins for electronic trades—desires additional account on exclusive commission basis. JAMES L. FITZSIMMONS, 39 Lackawanna Plaza, Bloomfield, New Jersey.

NEWLY FORMED SALES ORGANIZATION, WITH KNOWLEDGE OF PLASTICS, has time and space available to devote to your line of molded products (housewares, toys, novelties, etc.) Interested in representation metropolitan area. Write Box 1232, Modern Plastics.

MISCELLANEOUS

MR. MOLDER, join the "Bradley Box Exchange." It costs you nothing and many molders have derived thousands of dollars of business through our organization. Your entry fee is merely a sample of each molded plastic box you have available. . . . We have thousands of clients seeking molded styrene boxes for packaging and sales promotion. We now represent over 50 molders. Write today and send samples to BRADLEY ASSOCIATES, INC. "World's largest source for molded plastic boxes"—1652 N. Damen Ave., Chicago, Illinois.

IF YOU HAVE STOCK MOLDS OF HOUSEWARES, Toys, Notions, Novelties or Specialties, I can market your entire production to large Chain Stores, Department Stores and Jobbers on commission basis. Also interested to buy injection molds, above items, on royalty or outright purchase. Would consider small investment in going plant plus my services in promoting sales. Give full details. Reply Box 1204, Modern Plastics.

EASTERN SLUSH MOLDER with shipping, warehousing, and New York office facilities wishes permanent tieup with an injection molder with mold making facilities wherein they can represent injection molder through their sales organization and many contacts for custom molding opportunities. Reply Box 1235, Modern Plastics.

NEW DESIGN combines chess and checkers into one set. Conventional chess design has been completely replaced with a forceful and attractive use of lines which symbolize the moving power of each piece. Beginners learn the moves quickly and easily. Ideal for full size chess-checker set or for miniature or pocket size chess set. Protected by a design patent. Inventor prefers to lease manufacturing rights on a royalty basis but will consider outright sale. For full information write J. J. Crist, 1302 Auburn Court, Rockford, Ill.

WE ARE SOLICITING CONNECTIONS with an American firm dealing with the manufacture of articles for packaging, household, toy, automobile, electrical, and chemical industries. We are in a position to produce American articles of plastics in Germany on a license basis. We are able to manufacture die-castings weighing up to 300 grams. ISOPLASTIC WERK, Herbert Eitner, (1) Berlin-Marienfelde, Buckower Chaussee 60-70, Germany.

All classified advertisements payable in advance of publication
Closing date: 5th of preceding month; e.g., December 5th for January issue

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Up to 60 words (boxed)..$20.00	Up to 120 words (boxed)..$40.00	Up to 180 words (boxed)..$60.00

For further information address Classified Advertising Department,
Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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Low Cost OPERATION

Want volume injection molding with low die expense? Then investigate these small high-speed Moslo Minijectors—which in hundreds of cases are out-performing larger machines in turning out small molded pieces or parts. Every Minijector is built for lasting service and will provide economical, efficient, automatic operation.

MOSLO DUPLIMATIC MINIJECTOR—especially for insert molding of cord-plugs, switch parts, etc. A two-sided self-positioning lower mold section allows operator to remove finished molded part from the mold section and refill with new inserts while the other mold section is in cycle. Automatic hydraulic operation provides for complete operator safety. Mold casting area 40 square inches. Injection pressure 20,000 p.s.i. Injection capacity to 4 oz.

OTHER MODELS AVAILABLE

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¾ Oz. HC-75
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2½ Oz. Standard and High Speed

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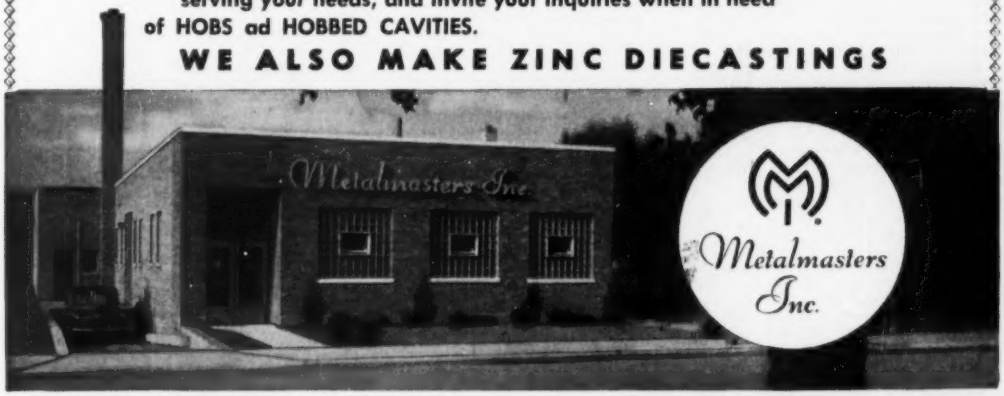

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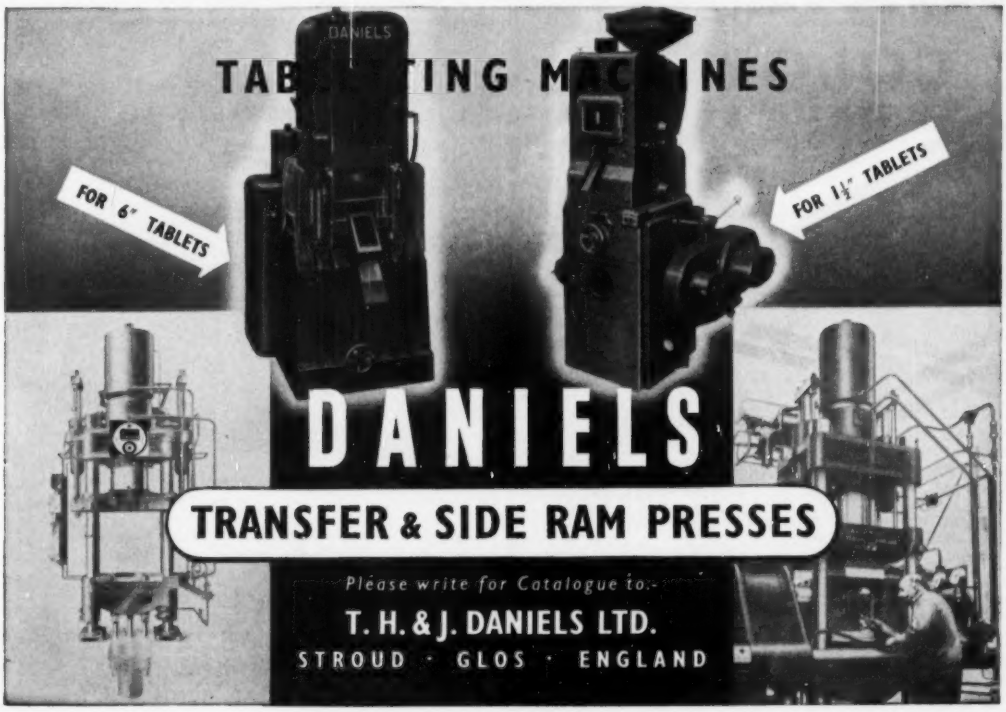

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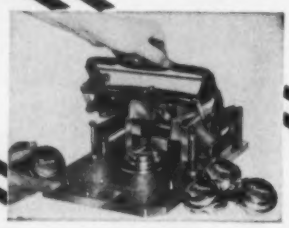

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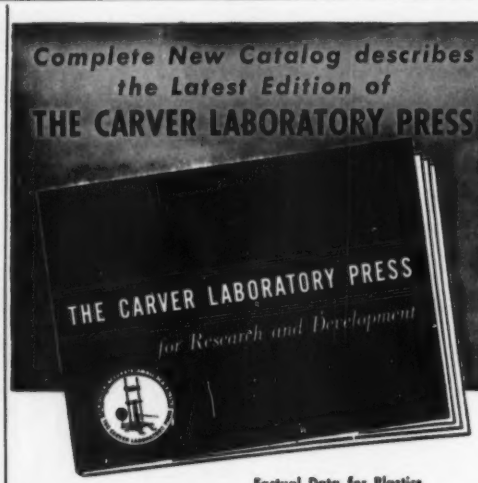

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